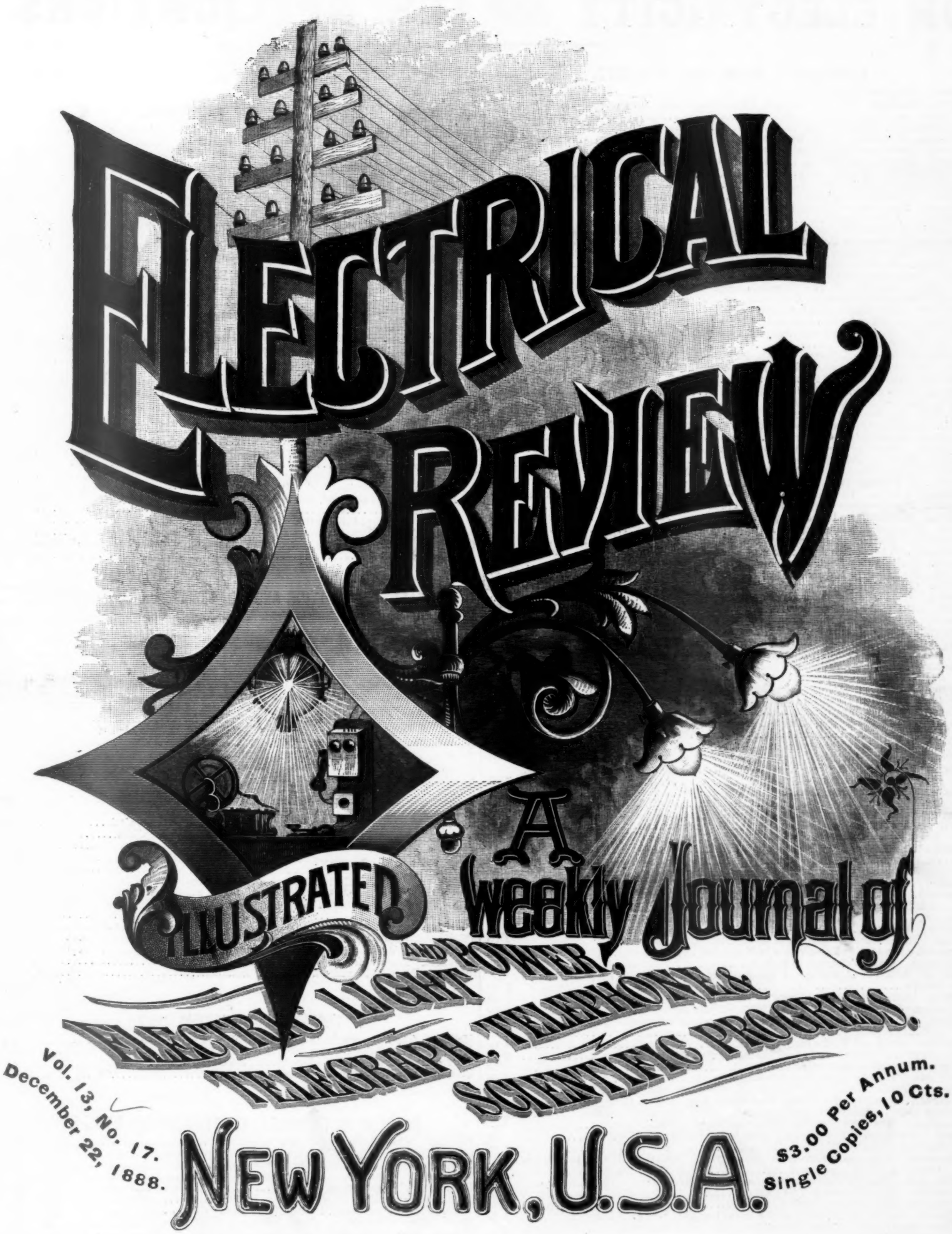
ELECTRICAL
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The Fowler Speed Indicator—An Accurate and Simple Instrument.

We illustrate herewith the Fowler speed indicator manufactured and owned by Messrs. Chandler and Farquhar, of Washington street, Boston, Mass. The instrument is simple, accurate, compact, and carefully made of steel, and nickel plated. It has two dials, one counting to 100 revolutions, the other registering by hundreds to 5,000. The index point on the 1,000 dial can be adjusted to zero with the finger, instead of tediously turning the dial all around to reach the above point (as in some other indicators). Right or left handed motion can be indicated. Another point in its favor is its cheapness, as it is put on the market at lower price than any other instrument that will register near as many revolutions. When desired, the manufacturers will furnish an extra point six inches long for use on electrical machines.

The St. Joseph Electric Railway Working Well.

The electric road installed by the Sprague Electric Railway and Motor Company, of New York, in the city of St. Joseph, Mo., has been in operation very successfully ever since its installation, and has been giving satisfaction to the management and public.

Since its installation, the road has been visited by a large number of street railway directors, from all parts of that section of the country, who have expressed themselves as very well pleased with the operation of the electric road.

The St. Joseph *Daily Gazette*, in recently speaking of the road, says:

"It should be a matter of pride to the citizens of St. Joseph that they are possessed of this electric railway, for, to say nothing of the material benefits accrued to the citizens by the increased service of the road, it is a very good advertising medium for our city. Nearly every day some gentlemen are in St. Joseph from some other city to investigate the system, and they come from all quarters of the United States. Yesterday a gentleman from Portland, Ore., was in the city for that purpose, and several days ago one from San Francisco on the same errand."

The success of the Union Passenger Street Railway has been so great, that the management have ordered an additional number of cars, and the Wyatt Park Railway, of St. Joseph, is now being equipped with electric apparatus upon the Sprague system.

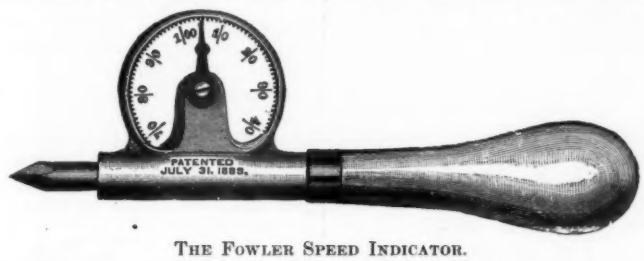
The electric equipment of this road includes eight cars of the latest design and pattern, equipped with lightning arresters, universal movement trolley arm, noiseless gearing, flexible suspension for motors, and all the other devices which the Sprague Company has adopted for electric railways installed upon their system.

The Postal Telegraph to Spread Southward.

The postal telegraph is soon to construct wires from Washington southward, with a view of establishing offices in the principal Southern cities. The Mackey-Bennett Commercial Cable is a part of the system, of which Mr. Albert B. Chandler is the president. It is understood that Mr. Jos. W. Kates is to be the general manager of the Southern department.

Sir David Salomons' Resistance Governor.

This instrument, says the London *Electrical Review*, has been designed by Sir David Salomons for use in connection with the well-known repulsion regulator, and is



THE FOWLER SPEED INDICATOR.

made by the Woodhouse and Rawson Electric Manufacturing Company under his patents. It is intended for automatically introducing or withdrawing resistance from a circuit in case of an alteration of E. M. F., and in its mechanical construction is similar to that of the Porte Manville governor. The ratchet wheels are driven from any convenient rotating shaft, and, on an alteration of the

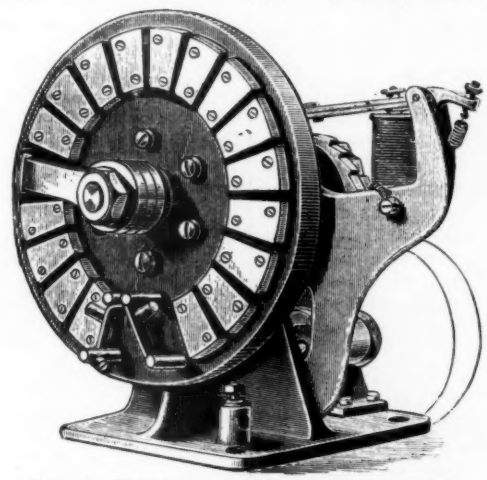


FIG. 1.—THE SALOMONS RESISTANCE GOVERNOR.

E. M. F., an electro-magnet draws one of the pawls into gearing with the ratchet wheel below it, causing the brush to move on to an adjacent contact, and so on till the proper E. M. F. has been reached by addition or subtraction of the necessary resistance. In case of the brush being carried right round to either extremity of the contact pieces, circuit is broken by its pressure against the contact pins.

Fig. 2 is another form of instrument designed for the same purpose. In this the ratchet wheels do not revolve from the shaft, but the brush is given a step-by-step movement on the action of the electro-magnets, combined with the motion of the anchor escapement, which is mechanically driven from a shaft.

—— The St. Johnsbury (Vt.) village trustees have closed a contract with the Thomson-Houston Electric Company, to light the village with electricity. The work will go on at once, and the lights will be in operation as soon as possible before January. The Thomson-Houston Company have closed a contract with the Water Power Company for the necessary power from the new dam below the village, taking a lease for ten years.

The Anaconda Mine to be Re-Opened.

It was reported by telegraph a few days since that the Anaconda mines and works of Butte, Montana, had been closed for the winter in consequence of an agreement with the copper syndicate, who had offered to allow the owners 2¼ to 4 cents per pound upon the producing capacity of the mine—that is, upon copper not produced, but which might be if the works were run at their usual output. Our later information states that the Anaconda mine and works have resumed operations with their full force. The shut-down was ordered in consequence of a strike on the Montana Union Railroad, which deprived the Anaconda of their usual supplies of coal and ore, and prevented the shipment of their product.

An Electric Locomotive.

An electrical locomotive is building at the New York Locomotive Works, in Rome, N. Y. The engine is to be operated solely by electricity, and is designed to run on all roads where steam is now used. It will weigh 15 tons, and when turned out

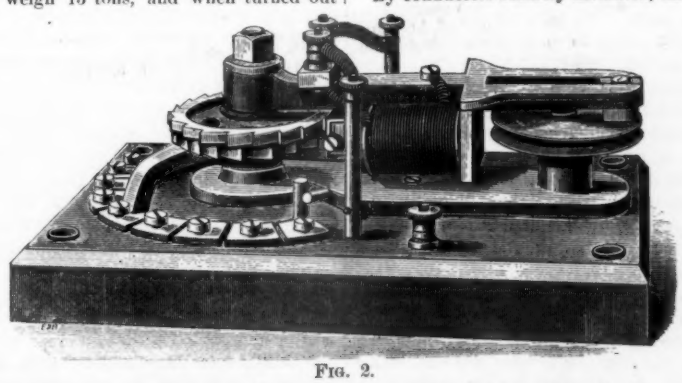


FIG. 2.

of the shop will be an exact counterpart of an ordinary locomotive, though considerably smaller and lighter. When finished an electrician from New York will take charge of it and place in it the electrical apparatus to be used as a motive power. The inventor is W. H. Darling, of Brooklyn.

How to Execute Criminals by Means of Electricity.

At the annual meeting of the Medico-Legal Society, of this city, held at the Fifth Avenue Hotel, December 12th, the chief topic of discussion was the "Best Method of Executing Criminals by Means of Electricity," in accordance with the new law of this State, which goes into effect January 1st, 1889.

The following paper, by Mr. Henry Guy Carleton, was read by Dr. Charles F. Stillman:

Mr. President and Gentlemen of the Medico-Legal Society:

The exhaustive report of Messrs. Elbridge T. Gerry, Alfred P. Southwick and Matthew Hale, commissioners, made to the legislature of this State, and the most learned report of your own committee, made at the last meeting of this society, leave but little to be said upon the subject of carrying into effect the sentence of death in capital cases by means of electricity, as now contemplated by the law.

The advisability of inflicting death instantaneously by a silent and invisible current, instead of by the counterweight, or trap and rope, is too apparent to need discussion.

The injury done to the community by the frequent bunglings of inexperienced executioners, by the concourse of morbid sightseers often admitted to the horrible scene, and by the sensational reports of the condemned man's last moments, last words and struggles, has already been ably shown.

The lowering of the dignity of the law, by carrying out its sentence in a manner calculated to shock the beholders, has been justly considered.

Experience has shown that capital punishment is a necessity of justice, but civilization demands that its infliction shall be stripped of barbarity, and that through it no harm come to the community, and these points also have been carefully weighed by the State Commission and by your committee.

It only remains, therefore, for me to offer you my opinion as to the form of apparatus to be used.

There can be no difference of opinion upon the question that an alternating current of 3,000 volts, transmitted from a dynamo, is capable of producing instant death, if properly applied, to a human being.

By conductors suitably insulated, this current may be safely and surely brought to the place of execution, and by means of the double-pole switch, familiar to every telegraph engineer, may be turned on or off with entire safety to the operator.

By a shunt and galvanometer, so easily

constructed as not to need description, and operated by the double-pole switch aforesaid, the operator of the death-apparatus may see that the current is on the wires before turning the switch.

Now, as to the proper place to apply this current, and the simplest form of apparatus to use.

To transmit the current through the arms might produce death, but would also cause excessive muscular contraction which would last long after life was extinct, and which might even be so great as to disarrange the apparatus.

To transmit the current through the arms and thence through the trunk and legs, is open to still greater objection on the same grounds.

To apply one pole to the apex of the heart and the other to the neck where it would reach and affect the phrenic nerve, would result in instant arrest of circulation and respiration, and hence death; but it would be necessary to partially strip the condemned man to accomplish this, and even then the apparatus would be difficult to adjust, and as executioners are neither electricians nor anatomists, mistakes could eastly be made.

To paralyze the brain is to immediately arrest all functions of the body, annihilate consciousness and sensation and produce death. The less resistance offered to an electric current the greater its energy. The smaller the compass of the organ to which the apparatus is to be applied, the simpler the mechanical form required. Consideration of these facts lead me to a conviction that the application of the electric current for this purpose should only be made to the condemned man's head.

I submit herewith an outline sketch of an apparatus which I have devised for the execution of criminals by electricity, and which embodies my ideas. Its parts are as follows:

1. A stout chair, *AA*, of wood, with its back inclined, as shown, securely fastened to the floor by suitable bolts.

2. Two stout leather bands, riveted to the chair, as shown, and capable of rapid tightening by means of their buckles.

3. A curved metal rod, preferably of copper, *K*, pressed forward and downward with moderate force by the spiral spring at the pivot, *SP*, and terminating in a slightly concave metal knob, *M*, covered with felt saturated with a strong solution of sulphate of zinc.

4. A rubber or leather collar, *G*, fastened by a buckle, as shown, and bearing a metal plate, *H*, also covered with felt saturated with a strong solution of sulphate of zinc, said plate being adjusted to the nape of the neck, over or just below the *medulla oblongata*, and bearing a foot or more of stout wire.

5. Two binding-posts, *D*, *D*, and two tubes of hard rubber or other insulating material, *R*, *R'*, conducting the wires beneath the floor to the double-pole switch, which can be located wherever desirable.

6. The head-strap, *W*, of leather, bearing three hooks, *S*, *S*, *S*, to which may be attached the cloth for veiling the face, and a padded head-cushion.

The angle of the back of the death-chair will give partial support to the body when it relaxes after death.

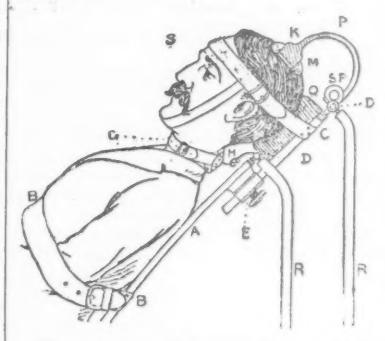
The two binding-posts are well insulated from the chair by hard rubber, as shown.

I should recommend that the pole, *P*, the knob, *K*, except its lower extremity, and the binding screw heads and trunks be encased in hard rubber as an additional precaution, although before the double-pole switch is turned no current can be on either conductor.

The adjustment of this apparatus should be very simple and rapid. The collar, *G*, is placed about his neck in the cell while he is being pinioned. When he is seated in the chair the executioner first adjusts the head-strap, then secures the wire, *H*, running from the collar to the binding-post, *D*, then hangs the face cloth to the hooks, *S*, *S*, *S*. By this time his assistant has fastened the buckles of the straps, *B*, *B*. The pole, *P*, is then thrown forward, the spring, *SP*, keeping it pressed against the skull. This operation, from the time the criminal seats himself until the switch is turned, should not exceed 15 seconds.

It might be urged that the hair would prove an obstacle to the current from the pole, *P*. It must be remembered that all felons are cropped on entering a penitentiary, and that the wet felt will insure the transmission of the current.

By proper guarding of the switch, no possible danger can be incurred by the operator or his assistants while adjusting the condemned, and after the current has been turned off the apparatus is again rendered harmless.



The report of the committee on "Best Method of Executing the Law, Punishing Criminals in Capital Cases by Electricity," was read. The main part of this report was published in the ELECTRICAL REVIEW of November 24th. Since that time the committee has added some details recording experiments made by electricity in killing animals. The report was read and discussed at some length.

Among the gentlemen present were a few representing electrical interests, who were called upon to speak to the report. Dr. Otto A. Moses, Ralph W. Pope and Mr. Geo. M. Phelps, expressed disapproval of the report, and also of the use of electricity for this purpose, and also some criticisms were made on the action of the committee in their tests against one system of electric lighting. Mr. Phelps thought the use of electricity gave the act of execution a sensational nature. Mr. Pope thought it was rather a late day to ask the advice of electricians after the matter had become a law.

Mr. Pope stated that he considered it unfortuate that electricity had been determined upon as the proper agent for the infliction of the death penalty, and its use had been approved by law to go into effect on the 1st of January without seeking the advice of electrical engineers until the eleventh hour, when nothing which they might say would be of any avail. This matter had been in the hands of physicians, who, if all reports were true, were well versed in the art of killing as well as of preserving life. The principal element of barbarity in the existing method was that of fixing the day on which a criminal was to be executed. It was one of those decrees of an all-wise Providence, that, in the natural course of events, none of us were aware of the time when we were to terminate our earthly existence. It might be to-day, or to-morrow, or next week, and in the face of this uncertainty our lives were passed in comparative freedom from anticipation of the fatal day. Had it been arranged otherwise, and had each of us been made aware of our earthly career, life would have been a period of continual misery. In this respect we might profitably follow the French practice, where the day fixed for execution is unknown to the victim, but he is awakened from a sound sleep, and in a few moments all is over. He believed that a similar provision had been made in the law under consideration, but the use of electricity had apparently made it essential that certain elaborate preparations should be made which added to the many objectionable features of the whole business. If he had been called upon for suggestions as to the most humane method of execution, he would have said that the cell of a condemned prisoner might be sealed and filled wish gas of some description, at an hour when he was asleep, and upon a date which had not been made known to him. He had no preference to any particular kind of gas, but he presumed that question might be readily settled. He would, however, object to water gas on account of its obnoxious smell.

If it were true, as had been alleged in the report of the committee, that 200 lives had already been sacrificed in the electric lighting business, he saw no necessity for introducing these very elaborate preparations for death. The very fact that the victim must be strapped down, and the current conveyed carefully to a vital part of the body, was in itself proof that doubt existed as to its adaptability for such a purpose. It was true that the death penalty could be inflicted by electricity. He did not think it proper, however, nor even necessary, to exaggerate the dangers arising from its use for public purposes. It was not, however, responsible for those disasters in which scores of victims were killed and maimed at one time, as is frequently the case in railroad accidents and steamboat explosions. The report had suggested that the alternating current be used. He considered this an unjust discrimination against a system of electrical distribution which had been adopted by two or three different companies, and which was bringing electric lighting into more general use. He was well aware of all the dangers which had been attributed to such a system of lighting, yet he had occasion, two or three times a week, to turn on lights of this character, and he felt no apprehension of sudden death. Its possibility was only one chance in a million or more, not by any means as probable as the fatality attending his crossing the streets of New York City, where every car and truck driver appears intent on running down every foot passenger who crosses his path. There had been a call for suggestions as to the proper method of applying electricity. In reply to this he had nothing to offer. The law had been passed, and was to go into effect. The best plan would, no doubt, be devised by those who were interested in such a subject. He was not.

Mr. S. S. Wheeler spoke at some length, and expressed the opinion that the tests had been impartially made.

Other speakers were Dr. Frederick Peterson, Dr. R. Ogden Doremus, H. P. Brown and Dr. Jacoby.

The report was finally adopted as reported by the committee, which was composed of Dr. Frederick Peterson, Dr. R. Ogden Doremus, Dr. J. Mount Bleyer, and Dr. Frank H. Ingram.

District of Columbia Appropriations.

THE BILL COMPLETED BY THE HOUSE COMMITTEE ON APPROPRIATIONS—ITS PROVISIONS.

The House appropriations committee has completed the District bill and given it out for publication to-day. The total of the bill is $4,927,193.61, which is a net reduction under the current law of $143,016.71.

CLEANING AND LIGHTING STREETS AND ALLEYS.

Appropriations for current expenses of streets are made as follows: Sweeping and cleaning (including suburban streets), $85,000, an increase of $8,000. The price per thousand yards for cleaning alleys is increased to 30 cents; for the parks, $18,000 is given; for lighting streets, etc., $115,000, an increase of $10,000; for electric lighting, $35,000, an increase of $5,000.

ELECTRIC LIGHTING AND OVERHEAD WIRES.

To this clause is added the following provision: And no wires for the operation of public or private electric lighting shall be erected or maintained on or over any of the streets or avenues of the cities of Washington and Georgetown after September 30th, 1890, but the Commissioners of the District of Columbia may authorize the temporary erection and maintenance of such wires in cases of necessity: *Provided further*, That the Commissioners of the District of Columbia shall make and enforce such regulations for the construction, maintenance, and operation of apparatus for electrical purposes as they may deem advisable, and such regulations so made shall have the same force and effect within the District of Columbia as if enacted by Congress: *And provided further*, That the Commissioners of the District of Columbia shall report to the first session of the Fifty-first Congress what deduction may be made for electric lighting both for annual and for five-year contracts, and that they be authorized to invite proposals for supplying said light at reduced rates, and in this they are not limited to any one system.

The Copper Situation.

A foreign despatch last week gives the following review of this matter:

"The copper situation takes on a new phase in the announcement to-day that the French syndicate has come to terms with the Anaconda Company, of Montana. The final closing of the extended contracts between La Société Industrielle et Commerciale des Meteux and the American producers, has been delayed by the Anaconda's holding back. An uneasy feeling has begun to prevail in some quarters that this company was going to hold out against the syndicate, and let copper stocks alone on this supposition, the idea being that with this great company in opposition the French company might have considerable difficulty in maintaining its position. In other words, it is all or nothing with M. Secretan's enterprise. One large producing company holding out against the syndicate might cause decided annoyance, even if it did not block the whole project.

"The Anaconda Company has been a source of more or less uncertainty. Its proprietors have been inclined to pursue an independent course, although it never has been doubted by people conversant with the copper situation and the methods of the French masters thereof, that an arrangement would be made by which the company would be included with the other American producers in the general plan.

"A private despatch from Butte, Montana, to-day announces that the Anaconda mines and smelters are shut down, and that production is entirely stopped until May 1, 1889. The explanation of this is that the company and the syndicate have come to terms. Authoritative declaration of this fact is not made, but it is self-evident. From what is known by leading copper authorities in Boston of the ways and methods of both La Société and Mr. Haggin's company, it is probable that Mr. Haggin figures out that at the syndicate's price of 12 cents, or thereabouts, per pound for his copper, he would make a net profit of about four cents per pound. This the syndicate has agreed to give on the basis of what the Anaconda would produce, were it in full operation for the period during which it is to shut down completely. In other words, the syndicate pays say four cents per pound to the Anaconda for the copper which it does not produce, thereby reducing the supplies which it has to carry, and eliminating a somewhat dangerous factor from the situation. The productive capacity of the Anaconda is figured at from 120 to 130 tons of copper per day. Call it 125 tons and it would be about 7,500,000 pounds per month, or, at four cents per pound, $300,000. These figures give an idea of the immensity of the enterprise which La Société has undertaken, and of which it gives new proof almost daily of its ability to maintain successfully."

The Parodoxes of Science.

The water which drowns us, a fluent stream, can be walked upon as ice. The bullet which, when fired from a musket, carries death, will be harmless if ground to dust before being fired. The crystallized part of the oil of roses, so graceful in its fragrance—a solid at ordinary temperatures, though readily volatile—is a compound substance containing exactly the same elements, and in exactly the same proportions, as the gas with which we light our streets. The tea which we daily drink with benefit and pleasure produces palpitations, nervous tremblings, and even paralysis, if taken in excess; yet the peculiar organic agent called theine, to which tea owes its qualities, may be taken by itself (as theine, not as tea) without any appreciable effect.

The water which will allay our burning thirst augments it when congealed into snow; so that it is stated by explorers of the Arctic regions that the natives "prefer enduring the utmost extremity of thirst rather than attempt to remove it by eating snow." Yet if the snow be melted it becomes drinkable water. Nevertheless, although if melted before entering the mouth it assuages thirst like other water, when melted in the mouth it has the opposite effect. To render this paradox more striking, we have only to remember that ice, which melts more slowly in the mouth, is very efficient in allaying thirst.

Electric Transmission.

ALL THE APPARATUS AT THE NEVADA MILL IN SUCCESSFUL OPERATION.

Last week, at Virginia City, the electrical plant at the Nevada mill for the transmission of power from the Sutro Tunnel level was tested, and found to work most satisfactorily. In this first test no ore was worked. It was merely a preliminary test made for the purpose of putting in motion all the machinery, observing it in motion, and so regulating the several parts of the apparatus, that all should work in unison.

The stamps were all hung up and the pans and rock-breakers run by the transmitted power. It was found that two of the six motors were capable of running the rock-breakers and 30 pans with perfect ease.

The start was made under the supervision of Mr. F. E. Smith, agent of the Brush Company. All the apparatus at the Sutro Tunnel level worked to perfection, but it will perhaps require two or three days to regulate the motors. These are upon one shaft, but each has its own governor. The springs of some of these governors are stiffer than those of the others, and will need to be so regulated that all the motors will work together in perfect harmony.

Mr. Smith says the working of the Pelton wheels and dynamos is perfect. He is much pleased with the power furnished by the Pelton wheels. They are six in number, and each has a diameter of 40 inches. The wheels work under the pressure of a column of water of the vertical height of 1,630 feet. As this pressure is always the same, the power never varies in even the smallest degree. This gives such steadiness to the dynamos that the current generated is unvarying. This part of the plant being perfect, it only remains, as already stated, to secure uniformity in the motion in the motors in the mill.

Among those present yesterday were Col. J. B. Overton, superintendent of the works of the Virginia and Gold Hill Water Company; Prof. F. E. Fielding, chief metallurgist of the Consolidated Virginia Assay Office; Chief Engineer Turner, of the California mill, and Superintendents A. C. Hamilton, E. D. Boyle, S. L. Jones, Roger Pendegast, foreman of the middle mines, and Evan Williams, the well-known mill man. All these gentlemen were well pleased with what they saw, and say that electrical transmission of energy has come to stay.

The contract with the Brush Company calls for the delivery of 60 per cent. of the energy developed by the Pelton wheels upon the machinery of the mill. Mr. Smith is quite confident that he will be able to do much better.

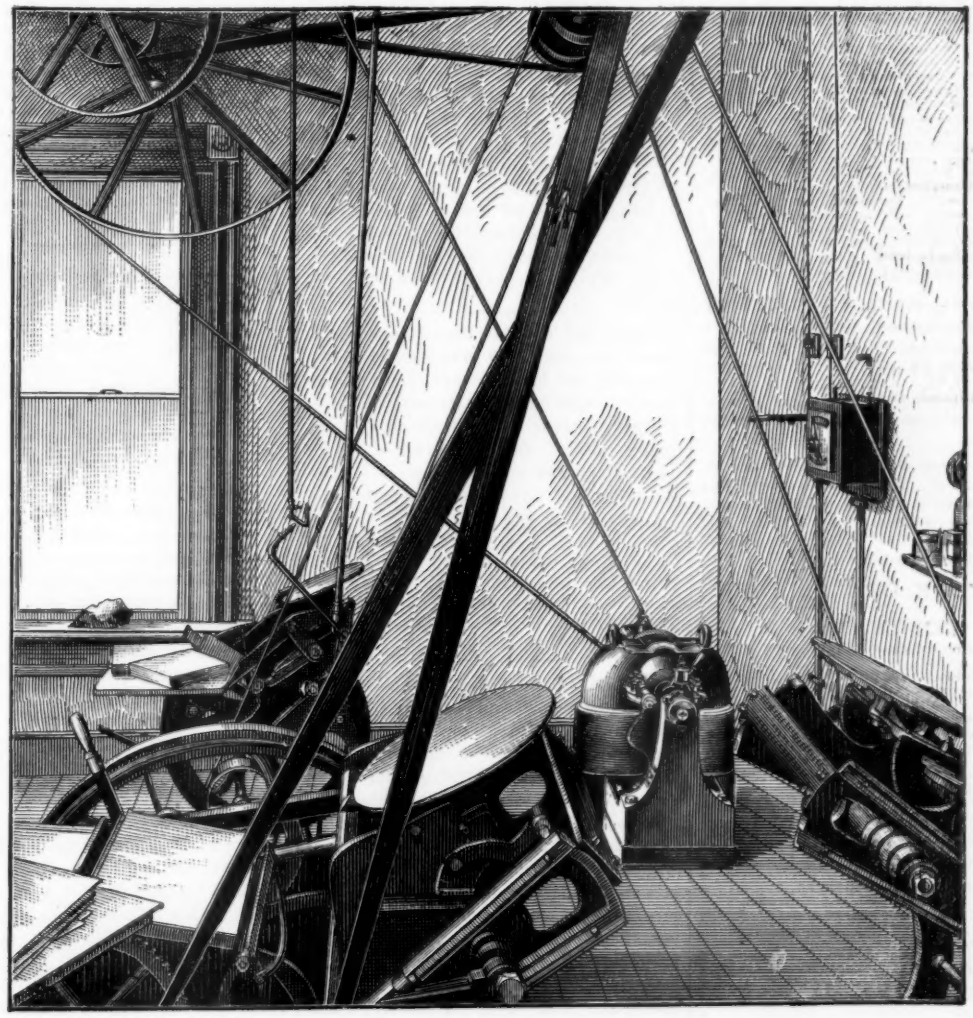
Professor Ewart on Electric Fishes.

Professor Cossar Ewart delivered a lecture on "The Electric Organs of Fishes," before the Natural History Society, Glasgow, recently. One of the most noteworthy facts about electric organs was that they were only found amongst fishes, and that although there were hundreds of different kinds of fishes, there were practically only three kinds that were known to have electric batteries sufficiently powerful to be of any evident use. The three familiar electric fishes provided with an electrical apparatus were the Malapterurns of the Nile and other African rivers; the Gymnotus of South America; and the Torpedo, found at times in our own waters, and in considerable numbers in the Mediterranean and the Atlantic. Of the others in which electric organs were known to exist, he need only mention the once sacred *Oxyrhynchus* of the Nile, and the skates and rays which abounded around the coast of Scotland. The batteries of the gymnotus were so powerful that a shock from a large active fish was strong enough to strike down a man, and numb away his consciousness for several hours.

—— Dr. P. H. Van der Weyde's address on "The Comparative Dangers of Alternate *vs.* Direct Electric Currents," read before the last convention of the National Electric Light Association, has been printed in pamphlet form.

The Electric Motor in the Printing Office.

That the advantages of the electric motors over isolated steam plants for printing are apparent to printers and newspapers, is shown by the constantly increasing demand for motors for this particular class of work. The fact that by the use of motors a single or group of presses can be used independently of the other machinery, has impressed itself upon printers as being both practical and economical. One other consideration (an important one, too) is the freedom from all noise, heat and dirt, which always accompany an isolated steam plant. The cut shows a portion of the Livermore & Knight printing office, in Providence, R. I. The motor shown was put in by the Thomson-Houston Electric Company, of Boston, Mass., while preparations were being made to change from electricity, which had been previously used, to steam power, and its operation was so successful that it was retained and recently replaced by a larger one. Its users say that they would scarcely know they had a motor, so little trouble has it caused, and so well and faithfully has it done its work.



LIVERMORE & KNIGHT PREFER THE ELECTRIC MOTOR FOR PRINTING OFFICE.

Tacoma Electric Railways.

Arrangements have been completed for the transfer of the entire street railway system of Tacoma to Henry Villard, of New York, D. H. Louderback, of Chicago, Paul Schulze, of this city, and a number of eastern capitalists. The purchasing syndicate is to retire the steam motor and substitute instead a Sprague electric motor for the entire system. The new management assumes control on the 7th of January. The City Council gave the franchise nearly two years ago for nearly all the principal streets and avenues of the city, for 50 years. The amount paid is $100,000.

—— A special meeting of the directors of the Cambridge Electric Light Company was held Monday afternoon, when it was voted to increase the capital stock from $100,000 to $200,000, and to add four more 125 horse-power boilers and a 500 horse-power condensing engine.

Maysville, Ky.—The Maysville Electric Light and Power Company, of Maysville. Capital stock, $12,000. M. A. King, G. S. Rosser, W. W. Ball and T. M. Dara, incorporators.

Columbus, O.—Articles of incorporation were filed with the Secretary of State by the Washington C. H. Light, Heat and Power Company. Capital stock, $10,000.

Worcester, Mass.—The Worcester Fire Appliance Company. Capital stock, $50,000. President, Dr. W. H. Raymenton; vice-president, Henry S. Pratt; secretary and treasurer, John C. Dewey.

Chicago, Ill.—Reynolds Telephone Organ and Piano Company, of Chicago. Capital stock, $500,000. Incorporators: Andrew Jackson Reynolds, William D. Moss, Charles W. Needham, Kendall Hurt and John Johnston.

Tacoma, W. T.—The Tacoma Western Railway Company, of Tacoma. Capital stock, $100,000. Trustees: G. W. Thompson, B. F. Thompson and W. L. Barker. To operate railways, telephones, and telegraph lines.

St. John, N. B.—The Brownley Electric Manufacturing Company. Capital stock, $10,000.

New York.—The Stout Electric and Storage Battery Company, of New York. Capital, $200,000.

New York.—The Eureka Telephone Company, limited. Capital stock, $5,000, which may be increased,

New York.—The Sunderland Telephone Company of New York has been incorporated, with a capital of $30,000.

Camden, N. J.—The Stanley Electric Company, of Camden. Capital stock, $10,000, of which $2,500 is said to be paid in.

Ashland, Ore.—Electric Light and Power Company. The incorporators are H. B. Carter, Fordyce Roper, A. C. Helm, L. D. Fielles, S. B. Galey. The object is to conduct electric light and furnish electric power in Ashland, Jackson County, Ore. The capital stock is $15,000; shares, $100 each.

Allegheny, Pa.—The Allegheny Arch Telegraph Company is chartered. The company proposes to construct arches over the principal streets, on which to string wires. The stockholders are Colonel James Andrews, Recorder W. H. Graham, D. F. Henry, Colonel W. A. Stone and John Bissell, of Rico, Col. Allegheny Councils has been asked for a right of way.

—— The semaphore signals, recently erected on the Amboy division of the Pennsylvania Railroad, are now in complete working order. Both telegraph operators and trainmen express themselves as pleased with the change, and say the signals will add to the safety of railroad travel.

Camden, N. J.—The Stanley Electric Company, of Camden. Capital stock, $10,000, of which $2,500 is said to be paid in.

Easton, Pa.—The Pennsylvania Motor Company, of Easton. Capital stock, $80,000. J. M. Young and others, incorporators.

Marshall, Tex.—The Phœnix Electric Light Company, of Marshall. Capital, $25,000. F. H. Gates and others, incorporators.

Dudley, Mass.—The Citizens' Electric Company, of Dudley. Capital stock, $10,000. And a plant will shortly be erected at this place.

Pittsburgh, Pa.—The Commercial Telegraph Company, of Pittsburgh. Capital stock not stated. W. G. Park and others, incorporators.

Carthage, Mo.—The Carthage Electric Light and Power Company, of Carthage. Capital stock, $30,000. W. B. Meyers, and others, incorporators.

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☞ No attention will be paid to communications without the *name and address of the writer.*

We invite correspondence from Electricians, Inventors, and the Telegraph and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

NEW YORK, DEC. 22, 1888.

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Mr. H. C. Davis, president of the Electric Club, has gone to Europe, to be absent several months, and will be engaged in looking after the interests of his father's large estate.

It was a pleasing sight, that of the Daft electrical motor drawing a train of four cars along the Ninth Avenue Elevated Road one evening last week. With such successes is energy, courage and brains rewarded. It has been a hard fight, and an up-hill one. Only let the experimentation continue, and before long we may see this, the most difficult and exacting railway service known, accomplished through electrical agency—no smoke, no soot, no cinders.

Now that the phonograph has become a practicality, new uses for it are rapidly appearing. As an aid in the study of the languages it will be invaluable. At present the student must needs content himself with listening to his teacher pronounce the strange sounding words for him, retaining, naturally enough, only a small part of what he has heard. But supposing he brought with him a phonograph. Then he could carry away all that had been said; indeed, a teacher could pronounce the next lesson for him, and thus enable him, while at home, to go over and over it till familiar with all its peculiarities of pronunciation.

If a man could lift himself into the air by tugging at the waistband of his trousers, he could fly. Now, the electrical accumulator, practically speaking, can do this, and hence it was long since prophesied that it would eventually be the means of aerial navigation. Last week, Peter Campbell, of Brooklyn, and James K. Allen, the aeronaut, ascended from Coney Island in a balloon guided by fan-propellers from an electrical battery. By this means the car was turned this way and that, sent hither and thither at the will of the operator, finally landing in the town of Sheepshead, L. I., whither it had been directed.

One Dr. D'Unger—of whom more anon—rushed into print a few days since, with the statement that Edison's quadruplex instrument, "while exceedingly ingenious and worthy of praise, is, in a business sense, quite valueless," and intimates that Gray's telautograph will fare no better as a commercial success. If Dr. Gray's telautograph becomes as much of a success as the "quad," which to-day is handling over one-half the telegrams of the Western Union and the Postal Companies, the inventor may certainly congratulate himself. The critic probably don't know what a quadruplex is, or what it does, or how.

Dr. J. M. Bleyer, in a communication to the *Medical Record*, explains another use for the phonograph, to wit: teaching, recording, reproducing and demonstrating the physical signs or sounds of the normal as well as of the diseased condition of the heart and lungs. Like the great Lick telescope in astronomy, the phonograph in medicine has opened a new field of investigation. He says: "While the deepest tone that our ears are capable of recognizing is one containing 16 vibrations a second, the phonograph will record 10 vibrations or less, and can then raise the pitch until we hear a reproduction from them. Similarly, vibrations above the highest rate audible to the ear can be recorded on the phonograph, and then reproduced by lowering the pitch until we actually hear the record of those inaudible pulsations."

The REVIEW invites attention to the quality and extent of its correspondence. Our outside writers, with headquarters in Boston, Philadelphia, Washington, Chicago, Kansas City, Charleston, etc., etc., are gentlemen of information and ability, whose communications amount to a great deal more than that class of correspondence devoted to business puffery. Business enterprise will always receive full recognition in these columns, and we are always glad to receive news from the manufacturers and dealers in electrical circles, to whose enterprise and courage a very great deal of the development in this industry may well be attributed. The reading public is becoming more and more interested in all that is transpiring in electrical circles in our country, and the REVIEW is not only proud of its staff that so ably contributes, but takes particular pride in the class of readers it has secured, and whose numbers are ever increasing.

COMMENT BY THE ELECTRICAL REPORTER.

It is a good sign when the daily papers employ electrical experts who can understandingly examine apparatus and systems before commenting upon them. Heretofore the practice was quite different, and every man connected with electrical contrivances will recall the long period of injustice, cruel injustice, when misrepresentation, though doubtless unintentional, was the order of the day; when the most unremitting efforts to improve the service and protect the public were regarded with indifference; when electrical purveyors were pictured like Stherno, Medusa, and Euryale; "gorgons and hydras and chimeras dire," with serpents about their heads, content to make money at whatever cost. The religious reporter would tackle the case of a fallen wire, and with the evidence of the loungers from a corner groggery and a cab driver as unsteady as his nag, succeed in putting considerable spirit though little truth into his account; then there was the theatrical critic outdoing his best legitimate efforts over the danger to firemen from the wires, etc. The *Sun* has got an expert now. He went up last week to have a look at the subways on West 24th and 25th streets. Here's his conclusion:

"As each form of the present electrical service differs absolutely from another in the matter of wire gauge and tension, it is not at all remarkable that the various companies operating the lines should decline to place their conductors in conduits which both experiment and common sense have shown will not meet their requirements. Those who have tried them will not do so again, and those who have not will not."

A Washington correspondent, writing of electric railways, says that Mr. H. C. F. Forrest, of Chicago, is in Washington examining the electric street railway in that city. He has made similar observations in other cities where such power is used for railway purposes, and reports that he is highly pleased with the result of his investigations.

Mayor York, of New Haven, Conn., has signed the electric light contract, the following addition having been agreed to: "Provided, that in case any improvements in the methods of electrical production shall be made during the term of the contract, whereby the cost of such lights as are herein contracted for shall be reduced, a proportionate reduction shall be made in the prices agreed to be paid."

THE ENEMIES OF THE ELECTRIC LIGHT WORKMAN.

In the wake of the electric light man, where he is at work in a new structure, there are many conspirators who aim to make his life a burden. They spring up like Jacks-in-the-box, and have many disguises. There is one whose outer garment is a striped apron with a capacious baggy pocket, whose implement of warfare is a modified tomahawk. He delights in testing the insulation of a plant by driving lathing nails through cables and grounding the circuit by means of wet laths and unseasoned joists. Another seems happiest when covered with hairy lime which he can slop and slather and plaster on tape-covered joints, where these are contiguous, and he seems even happier if, with a sharp trowel, he peels what he terms the "bark" off the wire. There is another who delights in driving bits of brick or stone into the hole in the wall where a wire comes through, and fills the chink with mortar. There is the carpenter who puts screws through the wires in fastening the covers to the pockets in the floor, and the scrub-woman who baptizes the wires with "labor-saving soap" suds. The plumber is a thorough workman—he cuts whatever may be in his way, and the steam-fitter makes room for his work in an equally lawless manner. But the ingenuous freedman who, as seasons roll round or chance determines, is to-day cook, to-morrow stable-boy, and the next day barber, footman or waiter, he can give them all pointers in doing up anything in the shape of an electric light wire, when he has a fair showing and a good "three row" brush on a long handle, with a bucket of whitewash. It is the very least of his concern whether it is in or out of doors, on cleats or on drawer knobs, in a cellar or along a face wall; whether it is alive or dead, whether of kerite, okonite, bitite, ozokorite, undertaker's or naked, he whitens it all the same, and no amount of caution is of any avail. The only possible way to head him off is to tell him that if he touches that wire with one hair of his brush, he will die instantly. Cuffee is apparently afraid of death.

ELEPHANTS AND ELECTRICITY.

It has become quite the "fad" to discuss electric killing nowadays, and public attention has recently been attracted to the possibilities of this method of execution—by a New York daily—in an elaborate article on the proposed death of an elephant named Chief, who is said to be bigger and wickeder than any other pachyderm in this country. He has already killed three of his keepers and maimed several others, and is said to be thoroughly bad. In fact, it was found necessary to build a fire under him once upon a time, to bring him to a realizing sense of the stern realities of life.

Our contemporary displays a picture of the aforesaid elephant, with an electrode attached to the middle of his forehead, and another affixed to the root of his tail. The conductors (our medico legal friends would, to avoid technicalities, call them rheaphores), led off to a window in a convenient building, where an unhappy looking youth with a frightened expression of countenance, has his hand on a circuit closer. This picture bears no inscription, and it is left to the imaginative reader to determine if it is intended to represent the "combination" before or after the execution (?).

From the mild and rather pleased, though slightly agitated facial expression of the elephant, together with the anxious look of the youth in the window, we are led to believe that the execution has come off!

But why the peculiar arrangement of the electrodes? Possibly this particular elephant wears his *medula oblongata* at the other end of his body from most elephants; or, possibly, convenience of attachment together with a regard for the beautiful, led the artist to his choice of the posterior place of attachment. Possibly he had read of one Harold P. Brown by name, and of his wonderful performances with dogs "and such small deer," and fired with a noble ambition for originality, selected parts of the anatomy to which electrodes have never before been attached, so far as history relates.

As to whether a direct or alternating current is to be used, "the deponent saith not"; neither is it recorded how direct the executioner will make for the tallest tree in the neighborhood, nor how many times per second he will alternate between a frantic desire to crawl into a hole and pull it in after him, and a profound wish that he had never undertaken the job.

Meanwhile, the scientific world waits breathless for the outcome of this experiment (?) pregnant with great hopes, which, according to the daily press, will be of incalculable value in the advancement of science.

South American electricians evidently have a nomenclature of their own, if we believe what is published. The other day a newspaper published some results of experiments in telegraphing without a wire. The pressure of the electric current used was said to be very strong, in proof of which its value in ohms was given. Telegraphy is far advanced in South America; so is electric lighting, if another newspaper electrician can be relied upon. He says that a battery is now in use for lighting houses which costs next to nothing for materials, is regenerative, the current is so harmless that no insulation or safety device is needed, and yet the light is far more powerful than any heretofore known. The paper states that by spring it will be placed on the market, and "the monopoly that will ride into power at once will be as overwhelming as a Democratic majority in Texas!"

OUR CHICAGO LETTER.

(Special Correspondence.)

The city's lamp-posts are beginning to show their lofty frames, from which, on the glad Christmas eve, an 171 electric lights will shine for the first time. The old gas posts are squatty and diminutive beside the new electric posts, which are graceful, and formed with some idea of symmetry and beauty. The upper half of the post is of turned wood, with projecting pins for the trimmer's convenience. Here and there some relic of the past is removed to make way for the innovation.

In the city of Cleveland, Ohio, there is quite a disposition to revive the practices of the olden times in Spain. The Board of Fire Commissioners the other day held a secret session, on some information contributed by a member of a self-organized and self-constituted smelling committee. The outcome of the board's meeting was the removal of Assistant-Chief and City Electrician H. H. Rebbeck, who has grown gray in the service, for defrauding the city in his capacity as purchasing agent, he having charged $100 each for telegraph registers, while the Gamewell catalogue lists registers at $60.

At the next meeting of the board Rebbeck will show to the members of that body that the Gamewell register at $60 is not the register the city of Cleveland is buying, and that the price, $100, is just what the city of Chicago and others pay for the same article, and has paid, and that the registers are worth over $40 in excess of those sold for $60.

It would be very hard indeed to convince any one who knows Chief Rebbeck, even a little bit, that he would take one single cent from the city he has so long and faithfully served, or from any one else. Somebody will apologize at the next meeting of the commissioners.

Frank B. Knight, the American Bell Incendiary, has been at it again. On the 12th instant at New Orleans, he made a bon-fire of 950—an assorted lot of telephones—once belonging to the National Improved, Crescent City, and New Orleans telephone companies. The instruments had been adjudged to infringe the Bell patents, and as they could not be used they were disposed of as stated.

Several changes in electrical circles were unintentionally omitted in my last. Mr. B. E. Sunny, formerly superintendent of the Chicago Telephone Company, and more recently president of the Chicago Arc Light and Power Company, has accepted a very responsible position with the Thomson-Houston Company.

Mr. C. H. Wilmerding, formerly of the Northwestern Electrical Accumulator Company, relieves Mr. Sunny of much of the work of the Arc Light and Power Company, having been appointed superintendent of that organization.

Mr. J. W. Johnson, formerly cashier of the Chicago Telephone Company, then with the Accumulator Company, and subsequently with the Western Electric Company, has been placed in charge of the city and county business of the Thomson-Houston Company.

The various electric companies represented here are in general as busy as bees in buckwheat

The Thomson-Houston Company, from their general office at Chicago, have sold, in the past 30 days, outfits of 1,037 arc and 5,600 incandescent lamp capacity.

The smiling countenance of Goodman Stanley, of Bridgeport, has been seen in our midst for some days. He tells me he carries no samples—wet or dry.

The Chicago Copper Refining Company at Blue Island, has an Edison plant running for the deposition of copper, placed by Messrs. Leonard & Izard, which gives a current of 1,000 amperes at 70 volts pressure. The dynamo is a number 32, and is doing excellent and very satisfactory work.

I called at the Central Electric Company's establishment a day or two ago, and found three of a kind—all M'cs—just too busy for anything in the way of socialibility.

The Electrical Supply Company reports heavy sales of P. and B. wire to parties who have heretofore considered the "Undertaker's" wire plenty good enough. C. C. H.

Chicago, Dec. 20, 1888.

OUR BOSTON LETTER.

(Special Correspondence.)

The American Tool and Machine Company has just furnished six of its belt controllers for dynamos to Harrison, Frazier & Co., for the isolated electric light plant in their sugar refinery there. Carter & Rogers, of Lebanon, N. H., who have just put in a Sawyer-Man plant, are also using one of these belt controllers, and one has been sent to the City Manufacturing Corporation, at New Bedford. The American Tool and Machine Company is also putting out a large number of its friction clutches in the electric field, which have the advantage of combining strength without clumsiness.

The Sawyer-Man Company is keeping up the record in its New England office, 620 Atlantic avenue. Recent installations are Bigelow & Dowse, Boston, 100 lights; Fiske's Wharf, 100 lights; Whitlen, Burdett & Young, 250 lights; Hathaway Building, 400 lights; Belden Bros. & Co., Northampton, 200 lights; Heywood Bros. & Co., Gardner, increase; Charles Heep, South Boston, 50 lights; Dedham jail and court house, 200 lights.

Mr. James B. Cahoon, formerly of the U. S. Navy, has become the electrical engineer of the Robinson-Foster Company, of 75 State street, which is entering the electric railroad and power field. Mr. Edward C. Boynton, Jr., of Newburgh, N. Y., and formerly at the Edison laboratory, will be superintendent of the factory, which is located near Marblehead. These two engagements presage well for the future success of the company.

At the Boston Electric Club Mr. Hamilton's paper was quite generally discussed after its delivery, and much of interest concerning the application of his theory to practical questions brought out. On next Wednesday evening Mr. Duncan will read a paper explaining the non-magnetic watch.

Dr. Moses Greeley Parker read his paper on the "Peculiar Rotary Motions Found in Lightning and other Electrical Currents" before the Society of Arts on Thursday evening. The paper was listened to very attentively, and with the numerous stereopticon illustrations proved a notable one in the annals of the society.

Mr. J. M. Orford, of the New England Electric Supply Company, Bridgeport, Conn., was a Boston visitor last week. Mr. Orford was on a pleasure trip, but incidentally looking up the interests of the Paiste snap switch, for which favorite piece of apparatus, as well as several others, his company are the sole New England agents.

T. W. S.

Boston, Dec. 19, 1888.

OUR WASHINGTON LETTER.

(Special Correspondence.)

A very timely and able paper on the subject of electric wires in the District of Columbia, prepared by Major Raymond, the engineer commissioner, accompanied with a voluminous mass of correspondence relating to the question, has just been submitted to Congress. A great deal of valuable information has been collected, and Major Raymond has given the subject much study. In discussing the details of the matter, however, he makes it very apparent that such a change must be gradual. He recommends that telegraph and telephone companies be given one year to place their wires underground and adds the qualification that, in case the former maintains any poles after that time, they shall pay an annual license of $25 per pole. Such a company as the Western Union might find it more expedient to pay that fee on a mile or two of poles carrying 50 wires than to build a conduit for the purpose. Another exemption in the report allows telephone companies to continue their poles in alleys, and this will save some long and heavy lines from going underground. When it comes to electric light wires Major Raymond makes a clean sweep and would have them all buried by September 30th, 1889, but he thinks the Thomson-Houston street car wires may remain, unless Congress should see fit to order electric power superseded by horses. One very important suggestion which has heretofore generally been omitted, is that the government should bury all its own wires without delay. The report does not favor the construction of conduits by the government, or by any corporation, to be rented to electrical companies, but recommends that each company should construct conduits for its own use, solely, and without paying for the privilege of occupying the streets—all work of this character to be done under the control of an electrical department, to be established, and the government to reserve the right to revoke all permits and purchase the conduits at any time. This seems to be on the presumption that the government may, at some future time, want to go into the electrical business itself. This report, like many others issued in the "war on the telegraph pole nuisance," takes no notice of the fact that one-half of the unsightly nuisance could be immediately corrected by removing useless poles and dead wires, and requiring others to be kept in good condition.

Superintendent Powell's specifications for lighting the House of Representatives, bids on which will be advertised for next week, require four boilers equivalent to 400 horse power; two high-speed automatic engines, 200 horse power each, and six dynamos with capacity for 500 sixteen candle power lamps each. It is proposed to light the House wing, the rotunda, and the lantern over the dome, for which there will be needed 2,500 sixteen candle power and 810 thirty-two candle power lamps. In the lantern there are to be three groups of 54 thirty-two candle power lamps, each of a different color to indicate when night sessions of Congress are being held—red for the Senate, green for the House, and white when both branches are in session. The specifications permit the use of a current having a potential between 50 and 120 volts. The plans embrace many ingenious and valuable features which have been devised by Mr. Powell. An extensive system of electric bells has also been provided for. Proposals will be received and examined by the committee and submitted to the House; an appropriation to pay for the work will be an after consideration.

The Light House Board is much gratified with the success of the lighted buoys in Gedney's Channel, New York Bay, which came safely through the recent severe storms. These are lighted by six 100 candle power Edison lamps from a dynamo located at Sandy Hook. The Board wants $5,250 to complete the light on the Statue of Liberty on Bedloe's Island.

In the Government's suit against the Bell Telephone Company, which, under the decision of the Supreme Court that the Government has a right to cancel a patent, was brought up in the Boston court on the 17th inst., the charge of fraud in the issuing of the Bell patent heretofore maintained was abandoned by the department of justice, and Drawbaugh's evidence-factory or some other concern will have to furnish proof of an earlier inventor of the telephone.

One more bonfire of infringing telephones will be celebrated at Asheville, N. C., and that will close the business in the south.

Fred Marean, a prominent telegraph operator employed in this city for many years, died on the 10th inst. He was a native of Susquehanna County, Pa., and a brother of the Western Union manager here. G. C. M.

Washington, D. C., Dec. 15, 1888.

At the American Institute Fair the Clark dynamo and arc light system exhibited received a medal for superiority.

The Western Union Telegraph Company and the Union Pacific Railway Company are at loggerheads in the United States Circuit Court.

The *causus belli* is the attempt of the railway company to cancel the contract between the two companies, by which the Western Union operates the railway company's lines on the defendant's road.

The petition for an injunction contains 155 specifications.

The Electric Club.

The meeting, Thursday night of this week (December 20th), promises to be quite largely attended. Professor Brackett, of the Chair of Physics, Princeton College, will be greeted by an appreciative audience. His talk on electrical matters will undoubtedly be interesting and instructive.

It is announced that during Christmas week, beginning December 24th, ladies accompanied by members are invited to visit the club house between the hours of 8 A. M. and 8.30 P. M. Through the efforts of Chairman E. M. Hamilton, of the Art Committee, a number of very fine paintings will be on view that week. The opening of the club for ladies until 8.30 P. M. makes it convenient for theatre parties to dine at the club, and several have already made engagements for six o'clock dinners.

It is stated that the Edison Electric Light Company, of which Mr. E. H. Johnston is the energetic and well-known president, has just obtained in Amsterdam, through the instrumentality of Henry Villard, the large sum of $10,000,000 of new capital, for use in extending the business of the company.

Electric Light Association Committee Meeting Proceedings.

A meeting of the Committee on Underground Conduits and Conductors of the National Electric Light Association was held at the Association headquarters, 16 East 23d street, New York, on Tuesday, December 11th. The meeting was called to order at two o'clock P. M. by Mr. E. T. Lynch, Jr., chairman. A preliminary discussion as to the present state of the art was entered into by the members present, and there seemed to be a very general impression that one of the most important things at present was to ascertain more fully and accurately than had heretofore been done just what has so far been accomplished in this country touching upon the undergrounding of arc light conductors. Several plans for accomplishing this were discussed, and the committee adjourned until Monday, December 17th, when definite plans for carrying out the work of the committee will be consummated. The members of this committee are: E. T. Lynch, Jr., chairman; I. H. Davis, F. B. Crocker, Gen. C. H. Barney, and Walter C. Kerr.

RATES TO CHICAGO.

The following communication has been received at the headquarters of the National Electric Light Association. Mr. George F. Porter, the active chairman of the transportation committee, N. E. L. A., is to be congratulated upon making so advantageous an arrangement for the Eastern members:

TRUNK LINE ASSOCIATION.

NATIONAL ELECTRIC LIGHT ASSOCIATION,
Meeting at Chicago, Feb. 19–21, 1888.

ALLAN V. GARRATT, Esq., *Sec.* and *Treas.*,
16 East 23d street, New York City.

Dear Sir: Mr. George F. Porter's application of the 10th inst., addressed to me, has been considered by the Trunk Line Passenger Committee, and it is agreed that persons from points in this committee's territory who pay full tariff first-class fare going to the meeting shall be returned at one-third the highest limited rate, on the committee's certificates; said certificates to be obtained of ticket agents at starting points (by whom they will be kept in stock), and to be indorsed by you at the meeting, in accordance with the terms of our explanatory circular which will be mailed to you later, as well as a copy of the committee's certificate.

Respectfully,
WM. FLEMMING, *Sec.*

We are informed by Mr. Garratt that he has been informed that the above rebate will apply to points east of Niagara Falls, N. Y., Buffalo, N. Y., Salamanca, N. Y., Pittsburgh, Pa., Bellaire, O., Wheeling, W. Va., and Parkersburg, W. Va.

The establishment of an uptown station for the general lighting of private dwellings has incited the glass people to unusual exertions in the artistic designing of globes and shades, and now, if you will drop into the Phœnix Glass Company's establishment, or any ornamental glass work store on Broadway, you will find much improvement in this regard during the last 12 months.

Telephonic News

*** Honolulu, H. I., has more telephones in use according to the population than any other city.

*** The Burlington, Vt., Telephone Company think strongly of rebuilding their line to St. Albans.

*** Kansas City reached the good round number of 2,500 telephone subscribers Friday, December 7th. This exchange is growing continually, and the service is of the best.

*** Advices from Ottawa, Ont., says that a company is being formed, with a capital of $2,000,000, for laying a telegraph cable from Blanc Sablon, at the straits of Bell Isle, to a point on the coast of Scotland or Ireland, to be hereafter decided. It is said that the Government will aid the project.

*** The cost of the telephone line from Paris to Brussels is already covered in the first year's receipts. The income is now at the rate of 120,000 francs a year. It is proposed to institute a simultaneous service of telegraph and telephone over this wire on the Van Rysselberghe system. The telephone system employed on this line is that of Dejongh, now in the hands of MM. Mourlon, of Brussels, who have obtained a gold medal for the system at the Brussels Exhibition, and have put up a number of telephone exchanges in Spain, Italy, Egypt, and Mexico, as well as in various English and Dutch colonies. The success obtained is greatly due to the absence of the necessity for adjustment, and the extreme clearness of the speaking.

*** An Associated Press dispatch from New Orleans, of Dec. 12, contains the following: Nine hundred and fifty telephones, heretofore the property of the National Improved Crescent City and New Orleans Telephone Companies, were burned in this city to-day under the direction of Frank B. Knight, of the American Bell Telephone Company, of Boston. These instruments were adjudged by the United States Court to infringe the patents of the Bell Company, and as they could not be utilized, they were destroyed. This is the outcome of the legal contest between the Bell Company and the above-named companies, defendants, which suit occupied the attention of the United States Court in this city for several weeks. In deciding the case, the court directed that all telephones belonging to the defendants be delivered to the Bell Company. This order was obeyed, and the instruments were disposed of by burning them.

*** When last heard from, Superintendent Smith, of the Missouri & Kansas Telephone Company, was sitting on nettles. He had just received the report that the company's patrons in this city numbered 2,499, and he didn't know whether the next move would be the dropping of one from the list, with a consequent course of fasting and prayer for the superintendent, or the adding of one, making the total 2,500, and meaning a grand "blow-out" for the whole force and some artistic work in red by Mr. Smith. As the elevator in the telephone building has been out of order for the last few days, I have been unable to reach "next to the roof" rooms of the company and ascertain which way the cat jumped. The company has just completed its metallic circuit between here and Topeka. The distance is 70 miles, and the company has strung 140 miles of No. 12 standard gauge copper wire. The circuit works to perfection. Ten thousand feet of cable have been strung up here and 11,000 more will be as soon as it arrives. The question of reduced telephone rates has not been settled yet. K.

A Chicago Alderman Thinks the City Should Accept the Telephone Company's Proposition.

Alderman Cullerton, of Chicago, speaking on the telephone question, is reported as follows: "This muddle is the result of listening to every busybody that cared to make a remonstrance to the Council. At the meeting of the finance committee Friday, we had one livery stable man, one druggist, and one man who said he was a publisher, who presumed to speak for all persons who use 'phones in this city. The talk of those three men was more influential with the committee than the facts within our knowledge, the suggestions of the Controller, and the advice of the Corporation Counsel. We could get service worth $15.000 for the city without cost, besides a revenue of $30,000 or $40,000 a year, without the surrender of a jot or tittle of the rights of the city over the telephone company. We rejected this offer because Messrs. Bodemann, Englehard and Peters, three men of whom we never heard before, told us they would not be satisfied unless rates were reduced. This is childish. I intend to ask the sense of the Council on the matter. We have fooled with this matter for a year and a half or more, and the city is out $60,000 by such fooling. Aldermen talk about litigation. It will take years to settle this matter in the courts. The patent of the telephone company will have expired before such lawyers as Fred. Winston and Norman Williams will allow themselves to be beaten, or their client to be ousted from its franchise. And we are also told to go to the Legislature. I believe the Legislature has tried its hand at this matter before," said Mr. Cullerton, with a shrewd smile which meant a good deal. "I'll tell you what'll happen if we go to the Legislature," continued the Alderman. "The State will get the revenue, and Chicago will get left. That's what happened in Iowa when Dubuque and Davenport petitioned for increased power over the telephone companies."

A Three Hundred Mile Hello.

"Hello, Hello!" said Mr. A. B. Uline, manager of the eastern division of the Commercial Telegraph Company's lines, as he sat in his office at Albany, N. Y., in company with two other persons, one of whom was a reporter of the *Argus*, last week. "Hello, Buffalo!"

"Hello!" came back the reply as distinctly as if he were talking with the Albany switching office. His mouth was close to the transmitter of the long-distance telephone, and he was speaking in an ordinary tone of voice.

"I want to speak to Mr. Hall," continued Mr. Uline, and Mr. E. J. Hall, manager of the western division of the company's lines, came to the Buffalo end of the line, and was introduced by Mr. Uline to the reporter over a wire more than 300 miles long. Then ensued a few moments' conversation between the two men, not a word being spoken that was not heard by the other as plainly as if the speakers were sitting in the same office half a dozen feet apart.

"What do you think of the long-distance line?" asked Mr. Hall.

"It works admirably—or, rather, wonderfully. How long a distance are you able to talk this way and be distinctly understood?"

"I have talked with the manager of the Boston office from here, 810 miles away, by wire, and our conversation was just as audible to each other as that which is now taking place between you and me."

"If you can converse with people 800 miles from you now, why isn't it just as easy to talk with London or Paris?"

"Well," came the reply, "the system is hardly perfect enough to allow that yet. It could be done, but it would require many heavy relays."

"How long do you think it will be before vocal communication may be had with European cities?"

"It is hard to tell. Progress toward perfection is being rapidly made, but the system is comparatively new yet. It probably will not be long before one will be able to talk with another two or three thousand miles away as easily as we now converse with each other."

After a few more words with Mr. Hall, the reporter bade him "good-by," and left the transmitter, wondering at the ingenuity of man that could contrive such things.

New Method for Improving the Working of Telegraphic Lines at Great Distances.

BY M. FERNAND GODFREY.

This method consists in establishing at each extremity of the line at the entrance to the telegraphic station an earth shunt having a co-efficient of self-induction so considerable that the well-known injurious effects resulting from the electrostatic capacity of the conductor, during the variable period of the current may be, if not compensated, at least greatly reduced by the inverse effects due to self-induction.

It is applicable to different systems of transmission, which may be divided into three classes:—1, Those in which all the emissions, whatever their character, positive or negative, should produce a signal and are separated by intervals during which the line ceases to be in communication with an electric source; 2, those in which the line is always in communication at the transmitting station with a battery sometimes positive and sometimes negative, the positive currents being used as working currents or printing currents, and the negative currents as currents for cessation or for spacing; 3, those which partake at once of the two former—as, for instance, certain transmitting apparatus with discharge currents.

In the first case the shunt affords at the beginning of the emission, and in virtue of its electro-magnetic inertia, an apparent considerable resistance, and it does not sensibly weaken the current which charges the line. It gives rise then at the end of the emission to an extra current, which acts to facilitate the discharge of the line, as an emission would do of a contrary direction succeeding without interruption to the former. The signals at the reception station are thus more distinctly spaced, and the recipient at the forwarding station is protected against the effects of the discharge current or return current.

In the second case the shunt likewise gives rise at the moment of each inversion to an extra current, acting immediately and producing the same effect as if the inverse battery had been momentarily augmented. It contributes, therefore, to diminish the duration of the variable period, and consequently to increase the speed of transmission.

In the third case its action is explained in the same manner as in the two others.

The above considerations concern the action of the shunt placed at the transmitting station. Now the complete system allows of a similar shunt at each end of the line. But it has long been known that an electro-magnetic shunt at the receiving station favors the rapidity of the transmissions and the distinctness of the signals. This is an effect which has long been known and utilized, especially on the long aerial lines in India.

The presence of a shunt of the same nature, about the middle of the line, produces an analogous effect, as I have found experimentally, but it involves the employment at the extremities of the line of more sensitive recipient apparatus, or of rather stronger batteries.

The method being applicable, as it has been said, to the generality of telegraphic systems, whatever may be the apparatus at the terminal or intermediate stations (transmitters, relays, recipients, etc.), affords a means of substituting a simpler arrangement for the so-called processes of discharge, or of mechanical compensation, or others which are now in use, especially in subterranean and in some submarine lines.

It has been successfully tried at the central telegraphic station, with the sanction of the Administration, upon several underground lines at great distances, among others on that from Paris to Angoulême (500 kilometers). In the course of experiments with this last locality, it has been found practicable to transmit at the rate of 20 words per minute with an ordinary Morse apparatus, without relays, intermediate or local, and utilizing only one direction of the current. The line had a resistance of 5,000 ohms and a capacity of 100 microfarads; the shunt, which comprised an electro-magnet with a closed magnetic circuit and a small auxiliary coil, had a resistance of 780 ohms and a co-efficient of self-induction equal to 12 practical units; the battery was formed of 50 Callaud elements.

Results equally satisfactory have been obtained with other apparatus, but the example given may suffice.

Experiments have proved that it is not practically indispensable to have a perfect neutralization of the inverse effects of the capacity of the line and of the self-induction of the derivation. The same electro-magnet has given equally good results on underground lines of from 250—350 kilometers; another has served for trials upon lines of 400 to 700 kilometers. It is sufficient for each fresh line to take the battery suitable for that line and then to vary a little the resistance of the auxiliary bobbin, or to break the magnetic circuit of the electro-magnet and remove some of the pieces of soft iron forming the keepers.

We may always for more delicate experiments have recourse to boxes containing a certain number of bobbins or of electro-magnets, arranged so that they may be grouped at pleasure.—*Comptes Rendus.*

Information in Regard to Ferro-Aluminum.

The Cowles Company has recently reduced the cost of the production of aluminum in iron, and this metal is now within the reach of all iron workers. They add to the purest commercial iron that can be obtained from one-tenth to one-twelfth of its weight of aluminum.

This alloy is crushed to small size and placed in a hot ladle, and on it is poured the molten iron. The smaller the metal is crushed, the easier it melts. The alloy melts and incorporates itself with the iron, rendering it very fluid, and decomposing the occluded gas. This decomposition produces a light slag, which at once rises to the surface, leaving a very fluid bath free from gas.

These conditions in practice produce a sharp and perfectly solid casting. It makes a uniform grain and takes away the tendency to chill. It prevents to an appreciable extend sand-scale and increases the elasticity of the iron. It also reduces shrinkage.

In low grade iron it increases the strength; but in first quality iron the strength remains about the same as without the addition of aluminum, but the structure is made so uniform that the metal works more satisfactorily in the landle or under a tool, and its greater fluidity makes more perfect castings. It is claimed that anyone of these improvements is enough to make the use of this alloy pay for itself.

In making the best quality of steel castings one pound of aluminum is added to 1,000 pounds of steel (that is, 10 pounds of ferro-aluminum containing 10 per cent. aluminum or 12 pounds of ferro-aluminum containing eight and one-third per cent. aluminum). If the desired effect is only the prevention of blow-holes in cast iron one-half this amount is sufficient.

By adding the first amount (1 lb. al. in 1,000 lbs. iron), more aluminum remains in the iron, producing the effects mentioned. The aluminum that prevents the blow-holes, does it by combining chemically with the gas which forms the holes, and therefore no longer exists as metallic aluminum.

In his decision in favor of the Western Union by Judge Olds on the 4th inst., he states that the company could not be compelled to put their wires underground, that the pole line was not a nuisance, and that the injunction must be dissolved. The company will at once replace the poles and wires and open the office, which has been closed for a year.

Interesting to Telegraphers.

AN ENTERTAINING STORY ABOUT EDISON IN WHICH A SMALL QUANTITY OF TRUTH IS IMPARTIALLY MIXED WITH A GREAT DEAL OF FICTION.

"I don't think," said a friend of Thomas A. Edison some days ago to a group seated in the rear room of one of the most comfortable hostleries of Orange, among whom was a reporter of the N. Y. *Sun*, "that you have ever heard the story of how the Wizard first came East. He was only a young man, careless, generous, jovial, and totally ignorant of the value of a dollar. He had been knocking round in Western towns in various small telegraph offices until the reputation of his wonderful swiftness as an operator got him into the central office of a Western city. From there he was ordered to report to Boston to fill a vacancy. It was warm weather for the season when he started East, and he donned linen trousers and a duster. By the time he reached Boston the weather had got cold, raw and stormy. He didn't care, and reported just as he was. Linen trousers and duster, topped by a slouchy, broad-brimmed hat, weren't the fashion in Boston in the best of weather, and on a raw day a man with a limp, wet duster on and wet linen trousers sticking to his legs was something to provoke a smile. He walked into the superintendent's room and said:

"'Here I am.'

"The superintendent eyed him from head to foot and said:

"'Who are you?'

"'Tom Edison.'

"'Who the devil's Tom Edison?'

"The young operator explained that he had been ordered to report for duty and the superintendent told him to sit down in the operating room. His advent here created much merriment, and the operators guyed him loud enough for him to hear them. He didn't care, though. Several hours later a New York sender noted for his swiftness called the office, and there was no one to take him.

"'Well, let that new fellow try him, anyway,' said the superintendent. Young Edison sat down, and for four hours and a half wrote out messages in a clear round hand, stuck a date and number on them, and threw them on the floor for the office boy to pick up. The time he took in numbering and dating were the only moments he was not writing out transmitted words. Faster and faster ticked the instrument, and faster and faster Edison's fingers, till the rapidity with which the messages came tumbling out and on the floor attracted the attention of other operators, who, when their work was done, gathered around to witness the spectacle. At the close of four hours and a half, and the New York business, there flashed from New York the salutation:

"'Hello!'

"'Hello yourself,' ticked back Edison.

"'Who the Hell are you?' rattled into the office with a big H.

"'Tom Edison,' was ticked back.

"'Shake, Tom Edison,' came over the wires.

"'With all my heart,' was the reply.

"'You are the first man in the country,' said the instrument, 'that could ever take me at my fastest, and the only one who could ever sit at the other end of my wire for more than two hours and a half. I'm proud to know you.'

"Mr. Edison had been experimenting and studying and improving telegraphy ever since he was 19 years old. He patented some of his inventions. He left the Boston office to try and sell his multiplex system to the Western Union. He was a careless looking young fellow when he walked into the office one day in New York, and asked them if they wanted to buy a patent.

"'What is it?' they asked.

"'Why, a means of sending two messages over the same wire in different directions at the same time,' said the young inventor.

"The Western Union officials lay back in their chairs and shouted in merriment.

"'Don't bother us with such nonsense as that,' said one at last.

"Mr. Edison tried to sell it to one of the rival companies that existed at the time. They also laughed to scorn the idea of doing such a feat.

"'Well,' remarked the inventor, as he turned carelessly away, 'if you ever get anything the matter with your plant that you can't straighten out yourselves, send round for me.'

"He took a little office and announced himself an electrical and telegraphic expert. Some time afterward the company had trouble with its Albany wire. The wire wasn't broken, but wouldn't work, and several days of investigation on the part of the company's electricians only served to puzzle them the more. As a forlorn hope, they sent for young Edison.

"'How long will you give me?' he asked.

"The manager laughed.

"'Six hours?' asked Edison.

"The manager laughed louder, and told him he'd need longer time than that. Edison sat down at the instrument, established communication with Albany by way of Pittsburgh, told the Albany office to put their best man at the instrument, and began a careful and rapid series of tests with all currents of all intensities. He had his Pittsburgh circuit instrument by his side, and directed the Albany operator in each movement from his end. The steps were simultaneous, and the Albany man telegraphed the results of each test. Edison compared them, made calculations, and in two hours and a half, told the officials that the trouble existed at a certain point he named on the line, and told them what it was. The officials telegraphed the office nearest this point, and an hour later messages were tripping gayly between New York and Albany. The company made him their superintendent immediately. Now he was in a position to command respect and attention. He induced the companies to test his patents, and sold them rapidly. He much improved his multiplex system, and sold that to the Western Union at ten times what he would have taken for it at the time they laughed at his first proposition. He simply informs the Western Union now when he has invented something new in telegraphy. Does it work? It works. How much? Hundred thousand. Check. That's the way he sells all his inventions nowadays.

"The public doesn't know it, but there are in the safes of the Western Union patents which, if applied, would nearly double the efficiency of the telegraph in the interests of public convenience. They are not used because it costs money to put them into use, and there is no competition to compel the Western Union to do the best it knows how to do. The company buys Mr. Edison's inventions, partly because they may want to use them some day, but chiefly because they don't want them to get into the hands of people who might, by these means, become dangerous competitors. They have to pay a fortune for each invention, and don't expect to use it when they get it, but the retention of their secure monopoly makes the policy a paying one."

The Secrecy of Electrical Executions.

In spite of the law, which goes into effect on January 1st next, that no account of the details of an execution shall be published in any newspaper, it is dollars to doughnuts that the first execution by electric method will be reported in full in every journal published in New York City, with cuts and elaborate technical and lay descriptions of the apparatus, its *modus operandi* and effect. Indeed, it wouldn't surprise me a particle to find in the five o'clock editions of our evening papers, which are on the streets for sale at 3.30, a perfect photograph of the entire scene. Legislatures are very powerful institutions, but legislators are the mere outcome of the whim and caprice of newspaper dictation. On the whole, it is a very safe bet.—*Jos. Howard in N. Y. Press.*

Judge Olds of Indiana seems to understand the value of the overhead wire system.

Telegraph Poles.

THEIR REMOVAL BY MUNICIPAL AUTHORITY CONTRARY TO THE ACT OF CONGRESS.

INDIANAPOLIS, December 5.—A decision affecting the rights of property owners and telegraph companies was recorded to-day at Columbia City, Ind., by Judge Olds. The suit originated at Fort Wayne, and was taken to Columbia City on a change of venue.

Judge Olds says, among other things, that the Western Union Telegraph Company having accepted the act of Congress of July, 1886, the Common Council of the city of Ft. Wayne could not compel the telegraph company to remove their poles from a post road, and that the city, under its police powers, could not pass any ordinance or do any act which would deprive the telegraph company of any right given by the act of Congress, or abridge any of its rights under that act.

The court refused to grant an injunction, dissolved the temporary injunction heretofore granted, and entered a general finding for the telegraph company.

Always be Sure You Understand the Message.

A good many stories are already current of mistakes caused by the telephone. They belong to the humorous class generally, but no great acumen is needed to perceive that most serious trouble might arise by the failure to catch some little word, or the misunderstanding of a long one. They have had such a terrible warning in Switzerland, if report be true, that we should not be surprised to hear of some restriction being imposed upon the use of the instrument in certain circumstances. It is said that the accident at Montreux last week was due to the careless transmission or the careless reception of a message. Perceiving that the reservoir attached to the Chillon electric tramway was dangerously full, the manager telephoned to his subordinates in charge: *Ne mettez plus d'eau*—"don't turn on any more water"; but the latter, not catching the all-important negative, understood simply *plus d'eau*—"more water." Accordingly he turned on a flood of water, the reservoir burst, a number of persons were drowned and vast damage was done. It is almost safe to assume that such a disaster will never occur again at Chillon, even if they continue to use the telephone. But risks of the same class always impend when instructions of the gravest character are transmitted briefly by word of mouth to an employé who may be half asleep, or tipsy, or distracted by a thousand circumstances. It is uncomfortable to think how wide is the field of such possibilities already, and how it enlarges every day. The transmitter of an important message should at least insist that the recipient repeat it after him. —*London Standard.*

The Electricians' Directory and Handbook for 1889.

The 1889 edition of this well-known directory and handbook, which claims to be the only international medium of intercommunication devoted to the electrical and allied trades, is in preparation. The publisher, Mr. G. Tucker, 1 Salisbury Court, Fleet street, London, England, asks us to notify that the time for receiving new names, addresses, corrections and advertisements will shortly expire, and that firms and individuals requiring their names inserted in the book must send by return mail.

We hope our friends will not delay forwarding particulars, as there is undoubtedly a large field open in the Old Country for American electrical manufactures, and it would therefore be well if our readers who wish to avail themselves of this medium of reaching the British public would send on forthwith, making their instructions to the publisher as clear and complete as possible.

The price of the directory, when ready, will be $1, which must be forwarded with order.

All further particulars will be promptly forwarded by the publisher upon receipt of inquiry.

TELEGRAPHIC

.... A novel use was made of a telegraph pole at Canon City, Colorado, the other day. At about 4 A. M., on the 4th instant, a posse of 20 men broke open the jail and tore down the steel cage in which a murderer named Witherell was confined. He fought them with portions of his bed which he broke up, but was finally overpowered after being wounded. He was then carried out and strung up to a telegraph pole within a short distance of the prison.

.... At Omaha, Neb., last Monday, Jas. M. Woolworth, the solicitor for the Western Union Telegraph Company, filed suit in equity before the United States Circuit Court against the Union Pacific Railway Company to prevent the latter from cancelling the contract existing between the two companies by which the telegraph company operates telegraph lines exclusively along the defendant's road. The railroad people say that under an act passed by Congress last August they are compelled to operate their own lines and will await the action of the courts.

.... A recent circular issued by Mr. Geo. G. Ward, secretary and general manager of the Commercial Cable Company, contains the following: "We desire to say to our patrons that the termination of the tariff war has in no wise interfered with the legitimate competition established by us. We also take this opportunity of assuring them that we never have been, nor are we now, in favor of a high rate, any statement made to the contrary notwithstanding. Our policy having been the subject of misrepresentation, we find it necessary to repeat these facts to the cabling public. The 'Commercial' aims to give the best possible service at a reasonable tariff. With underground lines and cable landing in New York City, and connections in Europe, its routes are the most direct and reliable, not being subject to interruption through storms."

The Boston Electric Club's Annual Election.

The annual meeting of the Electric Club passed off pleasantly and harmoniously at the club rooms Thursday evening. With but one or two dissenting votes on the nominees for executive committee, the ticket presented by the nominating committee and the following ticket, was unanimously elected: W. J. Denver president; H. B. Cram, A. L. Rohrer, Frank Fuller, G. L. Lang, vice-presidents; F. J. Boynton, treasurer; R. F. Ross, secretary; S. C. Peck, historian. Speeches were made by many of the newly elected board, and Mr. P. H. Alexander, the retiring president, was given a hearty vote of thanks for his efficient services during the year passed. Later in the evening, the executive committee organized by electing Col. C. M. Ransom, chairman, and Eliot L. Caldwell, secretary. The appointment of committees will be made at an adjoined meeting.

The Electric Light on Health.

We have noted in several of our exchanges that the electric light has been thought to affect unfavorably the health of those exposed to it. Now comes the statement from an English paper, which says that it is shown that the introduction of the electric light in the Central Savings Bank in London has reduced the average amount of absence from illness about two days a year for each person on the staff. This saves the bank about £640 sterling a year. The electricity costs more than gas, but the saving in clerk hire more than makes up for this, leaving £266 per year "to the good."

The Northern Pacific Railway Company are experimenting for heating and lighting the cars by electricity.

It is reported that the Montgomery, Ala., Electric Railroad plant, which was burned some time ago, will be rebuilt.

The citizens of South Denver, Col., are moving in a body for a complete system of electric lighting and water works.

The Aldermen of Albany, N. Y., have made an appropriation of $1,000 for suspension lamps in the center of streets.

The city of Mobile, Ala., has been enlarging its plant, having recently added an 85 arc plant of the Thomson-Houston pattern.

The town Council of Sherman, Tex., have appointed a committee to consider the matter of adopting a system of incandescent lighting for the streets.

The Thomson-Houston Electric Company has contracted to equip the Merrimac division of the Newburyport and Amesbury Railway. Three cars will be used.

J. L. Jayne, general agent for the Sprague Electric Railway and Motor Company for California, Arizona and Mexico, has recently opened an office at 328 Montgomery street, San Francisco.

The electric lights were turned on for the first time in Portland, Ore., Dec. 5th, and the Municipal Council located a large number of lamps for public lighting of streets and public buildings.

The Board of Public Works, of Nashville, Tenn., will receive until January 20 proposals for lighting the city with electric lights for a term of from three to five years, commencing next May.

A meeting of district superintendents of the Central New York Telephone and Telegraph Company was held in Utica, Dec. 7th. There were present W. D. Hanchette, Watertown; W. H. Girvan, Syracuse; Paul T. Brady, Cooperstown; B. J. Tracy, Little Falls; W. W. Nicholson, Utica; general manager, C. A. Nocholson, Utica; secretary and treasurer, F. G. Wood, Utica.

The Eddy Electric Manufacturing Company, of Windsor, Conn., have opened an office for the exhibition and sale of their motors at 115 Broadway, Room 17. They have on hand a number of sizes of their motors at this place. Messrs. Willis & Hunter, well known electrical engineers, represent the Eddy Company here, and have made a number of large sales during the past week.

The rapid growth of C. & C. Motor Company's business has compelled them recently to secure another factory at 402 and 404 Greenwich street, this city. Their new quarters are located in a large six-story building suitable for manufacturing, and the machinery will be run by their own motors, the current be supplied by dynamos and engines in the basement, and will be one of the most perfect of its kind in the country.

How the electric railways do commence to "boom" in Maine these days. The plans so far announced embrace one from Augusta to Gardiner; another is to construct one from Portland to Saccarappa and Cumberland Mills; a third is said to be a plan for an electric system over the tracks of the present Portland horse railway, and still another is to put the system in between Grand Falls, N. H., and Berwick, in this State. But the latest is proposed by Messrs. J. L. Smith, James Weymouth and A. O. Brown, of Old Town, who give notice of their intention of petitioning the Legislature to incorporate them as a street railroad company for the purpose of building a horse or electric railroad in that town.

The Electric Cars on the Fourth Avenue Line.

TO THE EDITOR OF ELECTRICAL REVIEW:

In a late communication we informed you that we hoped by our new method of regulations to so economize the use of the current from our battery as to make three round trips, or 36 miles, with one charge of battery, on the Fourth and Madison Avenues Line. I now take pleasure in informing you that we have accomplished that result, and that our large 18-foot cars, carrying unusually heavy loads of passengers, are now making three round trips from 36th street to the post office and back (or 36 miles), without any change of battery, so that now we change the battery but once a day, thus making a great saving in time. When you consider the long steep grades on Madison avenue, and the number of very sharp curves throughout the line, you may imagine how much farther one of our cars will run on a more favorable surface. But we do not intend to end here, as we now hope to be enabled to make a fourth trip, or 48 miles, on one charge, for the reason that at the end of our third trip now, we find the voltage of the battery is still above two volts per cell. When the battery is fully charged, the voltage stands at about 320 (144 cells). At the end of the third trip the voltage is still 300, and the car acted with as much force and life as it did on its first trip. We now go from 36th street to the post office and back, 12 miles, on an expenditure of less than 15 electrical h. p. Therefore we make the 36 miles on 45 electrical h. p. hours. Calculating the cost to be two cents per h. p. hour, you will perceive that it costs but 30 cents for energy for a round trip of 12 miles, or 2½ cents per mile. Assuming 75 miles for a car day, the cost would be $1.87.

These data are taken from our books at our electric station. They indicate the ampere hours and the h. p. hours put into the battery each day, and the cost of the same.

But this is by no means the limit of economy which we hope to reach, for we are now having manufactured a motor far more efficient than those at present in use. Our new cars will be at least two tons lighter than those at present running, so that with these two advantages in our favor, it is reasonable to hope that we shall reach still greater economy.

Yours very truly,

WM. BRACKEN, *Managing Director.*

—— The annual meeting of the Great Barrington (Mass.) Electric Light Company was held at the office of F. H. Wright, Esq., Tuesday. D. Ward Northrup, of Middletown, Conn., was elected president; Ward Lewis, vice-president and general manager; F. H. Wright, Esq., secretary and treasurer; D. Ward Northrup, H. R. Butler, Ward Lewis, H. J. Mignerey and F. H. Wright, directors.

Italian Exhibition Plant.

One of the most interesting features of the late Italian Exhibition, London, England, was the lighting plant which is shown in the accompanying engraving. The entire installation was provided by Messrs. Laing, Wharton & Down, the London representatives of the Thomson-Houston Electric Company, whose apparatus was used.

It was originally intended to operate about 250 lamps, for which service the nine 35 light dynamos were supplied; but the number of lamps soon run up to over 300, and thus without any spare machine the plant was worked without any interruption during the entire exhibition.

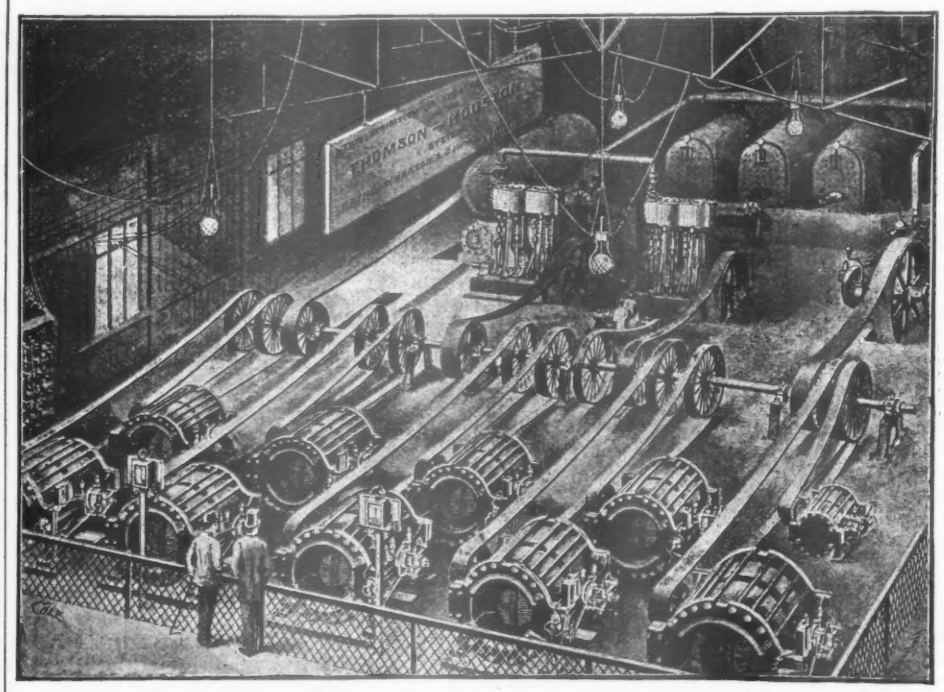
The installation attracted a great deal of attention from electrical men and others, and was very highly spoken of in the electrical papers containing descriptions of the exhibition.

Recent Sales by the Ball Electric Light Company.

Among their late sales the Ball Electric Light Company of New York City, report the following: Wilmington City Electric Co., Wilmington, Del., an increase of 75 arc lights; American Electric Light Co., of Kansas City, Mo., an increase of 75 arc lights. Each of these companies before purchased of them a K. 75-light, 2,000 candle-power arc dynamo complete, and increase as above with a second dynamo of the same size. This dynamo appears to be attracting special attention for street and commercial lighting, as giving light of the best, and being in every respect economical. It is claimed that this is the largest dynamo of this class yet manufactured by any company in the world, and at the same time the horse-power required at the pulley is but 52.5 pounds, and occupies less floor space than most dynamos carrying but 35 lights. Like all other dynamos of their system, it requires no foundation whatever, but is simply fastened lightly with wooden blocks to the floor.

In addition to these, they report the following sales; Phœnix Woolen Co., East Greenwich, R. I.; Stoughton Lighting Co., Stoughton, Mass.; Kirksville Light, Heat, Power and Water Co., Kirksville, Mo.; Stetson & Post Milling Co., Seattle, W. T.; Edison Electric Illuminating Co., of Hazleton, Pa.; C. S. Bradford, West Chester, Pa.; Newport Light Co., Newport, Ky.; Walworth Steam and Power Co., Boston, Mass.; West Coast Electric Light and Construction Co., San Francisco, Cal.; or a total of about 600 arc lights.

—— The directors of the Lynn and Boston R. R. Co., together with representatives of the Cleveland, O., Horse R. R., visited Lynn Thursday and tried the Thomson-Houston electric car. The electric system will soon be introduced in Cleveland.



THE THOMSON-HOUSTON SYSTEM AT THE LATE ITALIAN EXHIBITION.

Manufacturing Notes.

The Clark dynamo and new regulator were to be seen at work all during the American Institute Fair. A number of arc lamps furnished light for the adjoining exhibits.

Messrs. E. E. Garvin & Sons, the builders of fine machinery at No. 139 Centre street, had a splendid exhibition of their handiwork at the American Institute Fair. Lovers of skilled work found much to admire here. In electrical manufactures the machinery of this company is to be largely found, and is constantly increasing.

Messrs. Oxley, Giddings & Enos, have recently furnished the electric light fixtures for the new Opera House at Rochester, N. Y., which is lighted by the United States Electric Lighting Company. A number of interesting and original designs were used. The new Opera House at Rome, N. Y., is also being fitted up with electrical fixtures by this company.

Messrs. Williams & Potter, of 15 Cortlandt street, representatives of the "Straight Line" engines, have secured the power contract for the handsome new building of the New York *Times*, and will put in two 60 horse-power engines. This building is to be lighted by the United States Electric Lighting Company, and will, both electrically and from an engine standpoint, be as it should be a model plant. Messrs. Williams & Potter have also contracted to furnish 135 horse-power engine for the Freundschaft Club, 72d street and Fourth avenue. This club house is being fitted up in magnificent style, the electrical wiring being done by Mr. Geo. H. Pride.

The National Pipe Bending Company, of New Haven, Conn., manufacturers of the National Feed Water Heaters, report sales of over 70 for the last two months, aggregating over 11,000 horse-power. They have supplied one 600 horse-power to the new Boston Electric Light Company station, one 500 horse-power to the Cambridge Electric Light Company station, one 500 horse-power to the new station at Baltimore, Md., one 500 horse-power to the West End Street R. R. Company, of Boston, Mass., one 500 horse-power to the Beverly Electric Light Company, Beverly, Mass., one 400 horse-power to the Lynn Gas Electric Light Company, one 500 horse-power to the Auburn Electric Light Company, Auburn, N. Y., one 200 horse-power to the electric railroad station at Scranton, Pa., one 100 horse-power to Chicago, and eight 100 horse-power heaters to stations in the West and on the Pacific coast.

The Thomson-Houston Company of Boston have recently sold the Standard Light and Power Company, Montpelier, Vt., one 45-light arc dynamo; Canastota Electric Light and Power Company, Canastota, Ia., one 500-light alternating current dynamo; Lehigh Valley Railway Company, So. Eastern, Pa., one 50-light arc dynamo; Georgia Electric Light Company, Atlanta, Ga., three 50-light arc dynamos; Hartford Electric Light Company, Hartford, Conn., one 1,000-light alternating current dynamo; North Attleboro Steam and Electric Company, North Attleboro, Mass., one 40-light arc dynamo; New Bedford Gas Light Company, New Bedford, Mass., two 50-light arc dynamos; San Antonio Thomson-Houston Electric Company, San Antonio, Tex., one 1,000-light alternating current dynamo; Framingham Electric Company, So. Framingham, Mass., one 500-light alternating current dynamo; Charleston Light and Power Company, Charleston, S. C., one 500-light alternating current dynamo; Paterson Electric Light Co., Paterson, N. J., four 400-light incandescent, one 50 and one 45-light arc dynamos; Concord Electric Light Company, Concord, N. H., one 50-light arc dynamo; at Hillsboro, O., two 35-light arc dynamos; Union City, Ind., one 35-light arc dynamo.

Electric Light Proposals Wanted.

Proposals are wanted for a system of electric lighting for the city of Galveston, Tex. The committee of lighting may be addressed.

Proposals for lighting Anoka, Minn., by electricity. The committee on lighting may be addressed.

Proposals are wanted for lighting by electricity the town of Sadalia, Mo. The committee of lighting may be addressed.

The Electric Lights Under the Cascade Mountains—How it is Done.

Chief Engineer E. H. McHenry, of the Stampede tunnel, has furnished the following interesting article on the electric plant now on the ground at the tunnel, and which will be started to-morrow :

The plant was furnished by the Northwestern Electric Supply and Construction Company, of Seattle, W. T. It consists of a 300-light new style Edison municipal dyname, constructed to run at a pressure of 1,200 volts. Self-lubricating bearings reduce the necessary attendance to a minimum. The lamps, 300 in number, are 30-candle-power each. Light iron brackets from the sides support these lamps at intervals of 66⅔ feet on each side, giving one lamp to every 33⅓ feet.

The lamps are not placed as high as customary, it being quite an object to avoid the smoke accumulating in the crown of the arch.

The plan of wiring is peculiar to the system. Six complete circuits are required, which have a common return wire for all. A "pole box," containing a switch and safety catch, connects each circuit with the common return. This arrangement permits any one or all sections to be lighted at will, for convenience of workmen or trains. The tunnel in general is free from leaks, but where they occur, Clark's triple insulated wire is used.

The system is operated from the "east end," and is driven by a double 13½-inch Leffell mining wheel. The falls of Mosquito creek, almost directly over the east portal, furnish a hydraulic head of 160 feet, with but 400 feet of piping.

During the dry season, the power is furnished by a steam plant, consisting of a 50 horse-power high speed Ball engine, and a 60 horse-power steel boiler. The dynamo is arranged to connect with either the engine or wheel, or with both, the engine being used as an auxiliary in the latter case.

Water is furnished from the turbine supply pipe to a six inch pipe, laid throughout the length of the tunnel. This pipe was used during construction, to furnish compressed air to the rock drills, but is now used as a fire protection. Hydrant cocks are provided at suitable intervals, and hose distributed at several points. In the event of fire breaking out in the timber lining or approach snow-sheds, one or more streams, under a constant pressure of 71 pounds, can be quickly applied at any point. In addition to the above precautions, a complete telephone system is in use throughout the tunnel, connecting with the east and west end stations.

Electrical Executions will be Reported.

The point made by electricians that the electrical method of executing criminals is a most sensational one, is well proven by the startling head lines relating to it that continually appear in the daily press. One feature of this new State law is attracting much attention from the metropolitan press, namely, that section making it a misdemeanor for any detail of the execution to be published. The Constitution on the other hand says: "No law shall be passed to restrain or abridge the liberty of speech or of the press."

The N. Y. *Daily World* has sought the views of the editors of New York State on the question, and has asked them whether they regard the law as constitutional; whether they intend to obey it, and whether they will continue to print the news of executions. We quote a number of these interviews :

The Rev. George H. Hepworth, editor of the *Herald:* "We get news and we publish it when we get it, and that clause will not change our policy. It should certainly be repealed. The newspapers, as a whole, undoubtedly represent public opinion, and every newspaper is naturally opposed to restricting the freedom of the press, and I am sure the public will agree with them in the matter. It appears to me to be a foolish provision, and one that the authorities will find it very difficult to enforce, and surely the courts must decide it unconstitutional when it comes before them."

Col. Wm. L. Brown, business manager of the *News*—So far as the *News* is concerned it will print all of the interesting news obtainable regardless of legislation. Executing murderers is the execution of a process of the courts, and if the law can forbid the publication of the details of the manner in which that process is executed it can also say we must not publish accounts of criminal trials. This is exactly like the publication of lottery drawings. The laws prohibit advertising a lottery, but we have the most competent lega' authority for saying that after the drawings no law can prohibit us from publishing the numbers drawn. This prohibitory provision of the Electrical Execution law is nonsensical and unconstitutional, and I am not in the slightest degree afraid of it.

W. F. G. Shanks, editor of the *Star*—I think it would be a good thing if the details of executions could be kept from the public, but they cannot. They are sure to leak out and be published. This clause of the law is clearly unconstitutional and cannot stand. The papers will doubtless all print whatever of the details they can secure, and it would have been better to have applied the restrictions to the witnesses of the executions, for even if the reliable papers should attempt to obey the law as it stands, unscrupulous journals would violate it and publish such details as they could obtain, embellished to suit their own fancies.

Robert P. Porter, editor of the *Press*—I cannot conceive of newspaper men having two opinions on the subject. It is evidently an attempt to abridge the freedom of the press, and in my judgment cannot stand. They may possibly prevent our getting the news, but if we get it we will certainly print it. How is the public to know that the law has been obeyed and the sentence of the court carried out if the events that transpire are not made public? A few men might experiment upon the condemned men and indulge in any species of brutality if they knew they were to be screened by the law. This clause cannot stand in the face of the Constitution, and even if it could it should not.

Ernest C. Brown, manager of the *Graphic*—If we get hold of the details we will publish them without fear of the consequences, as the law is clearly unconstitutional in my opinion. Such a clause should never have been inserted and, now that attention had been called to it, should be promptly repealed. No attempt to abridge the freedom of the press will be allowed to succeed in this city. The restriction is doubtless the result of carelessness, as surely the Legislature would not wilfully make such an effort as is embodied in this clause.

George Worthington, editor of the ELECTRICAL REVIEW—I am opposed to the entire law, and especially opposed to this clause. I consider executing murderers by electricity an unnecessary and unwarranted debasement of one of the most enlightening elements of the age. I do not believe it is practicable from a scientific standpoint. As to this suppression clause, aside from the question of legality, it is not in the interest of public good, as there is no certainty that people apparently killed by electricity cannot be resuscitated, and secrecy would enable the executioners to cover up any blunders they might make. I will certainly publish the details, if I can get them, for the entire scientific world will be interested in the experiment.

Edward T. Flynn, editor of the *Telegram*—I propose to publish all of the facts and details I can get hold of regardless of that clause. They can arreast me if they choose, and if they arreast all of the editors who publish the reports, that will make another sensation and be another good story for us to publish. As ours is an evening paper and the executions will take place in the morning, we will lead the way for the morning papers and they can tell from my fate what will become of them. In my opinion the clause is clearly unconstitutional and nonsensical in addition.

Whitelaw Reid, of the *Tribune*, was reported by his outer guard to be engaged and too busy to see the reporter. Mr. Lyman said he had not heard his chief express an opinion on the subject, but from his knowledge of Mr. Reid's methods he would judge he would publish the news.

Managing Editor Coats, of the *Mail and Express*—We will publish the news in so far as is consistent with our ideas of journalism. In the absence of Col. Shepard I do not care to say more.

G. C. Eggleston, managing editor of the *Commercial Advertiser*—I look upon that clause exactly as I would upon a statute passed by the Legislature requiring newspapers to use a particular style of type in printing articles. It is a statute which the Legislature had no constitutional right to pass, and it is therefore as much a matter of indifference as is the opinion of the average New York legislator, upon any other subject that involves discretion or knowledge. We will publish such facts relative to electrical executions as we deem proper for publication.

The *Sun* says editorally : "A more utterly indefensible prohibition was never enacted. * * * It is impossible to perceive any valid reason for thus endeavoring to keep the public in ignorance on so important a subject. * * * The Electrical Execution bill, so far as it attempts to restrain the newspapers from publishing accounts of the manner in which the death penalty is inflicted, seems to us plainly in conflict with the Constitution."

—— The Edison Electric Light Company at Schenectady, N. Y., has bought one of the woven wire belts manufactured in Spencer, Mass., and will subject it to severe tests to ascertain its fitness to take the place of leather belting in the running of dynamos, the object being to eliminate flickering caused by the slipping of the belts.

—— The Brush Electric Company, of Cleveland, Ohio, have just received orders from the California Electric Light Company, of San Francisco, Cal., for three No. 8 machines to increase the capacity of the San Francisco station, and five No. 8 machines, with complement of lamps, to be used for central station lighting in Portland, Ore.

—— A. W. McCausland has resigned his position as manager of the Gardiner Branch of the Kennebec Light and Heat Company's electric plant. He has been interested in the electric lighting business longer than most any other man in Maine, having introduced the arc light into Gardiner in the fall of 1881 during the G. A. R. fair of that year.

—— A petition signed by 99 taxpayers of the town of Wakefield. Mass., was presented to the town to establish and maintain hydrants and electric lights in the villages of Wakefield and Peace Dale. After consideration and discussion, the matter referring to hydrants was continued one month, and the council voted not to expend any money for electric lights.

—— The recapitalized stock of the Malden Electric Company will be $100,000. They commence the payment of quarterly dividends at the rate of eight per cent. per annum on January 1st proximo. The company has ordered additional engines and dynamos to prepare for its rapidly increasing business. The introduction of meters makes it possible to light public halls and private houses economically, and orders in this direction are rapidly coming in.

—— At the instance of those interested in establishing a company for supplying the Edison electric light in Lowell, a committee was chosen to go to New York and look into the matter and report. The committee consists of Messrs. A. S. Lyon of the Lowell Manufacturing Company, Dea. W. H. Wiggin and Dea. James G. Buttrick, three gentlemen who have no interest in the enterprise, and who go merely as the agents of those who are interested. They visited New York last week.

—— On Wednesday, October 5th, the City Council granted the Fremont, Ohio, Electric Light and Power Company a franchise to erect poles, etc., and maintain a plant to furnish electric light for the city, and for business purposes. Work was commenced immediately, and the plant will be in operation at an early date. The officers of the company are: D. A. Ranck, president; Frank Heim, vice-president; H. E. Woods, secretary and treasurer; directors, W. R. Caulkins, D. A. Ranck, J. H. Clauss, Frank Heim and S. A. McLean.

—— Mr. B. E. Sunny, long superintendent of the Chicago Telephone Company, and for the past 10 months president of the Chicago Arc Light and Power Company, has accepted a responsible and lucrative position with the Thomson-Houston Electric Company, with headquarters at No. 148 Michigan avenue, and during the frequent absence of Mr. S. A. Barton, the general manager, will have charge or the Western business of that large corporation. He will probably remain as president of the arc light company at least until spring.

—— The electric light as a fish catcher is in actual operation in the deep seas, and now Mr. G. V. Hudson comes forward to prove its efficacy as a moth catcher. Its fascinating power over insects would appear to be much greater than that of an ordinary light. Mr. Hudson describes in the *Entomologist* the "largest assemblage of moths he has ever seen in New Zealand." They were flying round an electric light suspended from the yard-arm of the steamship "Aorangi," in Wellington harbor.

ELECTRIC LIGHT NEWS

—— Milford, Mass., is to try the meter system in incandescent lighting.

—— The town Council of Vicksburg, Miss , are contemplating lighting the town by electricity.

—— The town Council of Pocomoke, Md., are contemplating lighting the town by electric lights.

—— The Colorado Electric Company, of Denver, Col., have recently added a number of Brush arc lamps to their plant.

—— The new building for the Kansas City, Mo., Electric Light Company is nearly completed for the Edison plant.

—— Another Brush incandescent electric light plant has just been placed in the works of the Standard Oil Company, Cleveland, Ohio.

—— The Selectmen of Middleboro, Mass., are willing to give a five-year contract to an electric lighting company. Here's your chance, boys.

—— Amherst, Mass., has about decided on electric illumination, and the Selectmen have reported in favor of the Thomson-Houston system.

—— W. T. Johnson, of Milford, Del., is negotiating to erect an electric light plant to cost about $7,500. It is proposed to form a stock company.

—— The commissioner of patents has just rendered a decision supporting Mr. Julien's claim for an unoxidizable alloy used in his storage battery.

—— The demand for electric lights in Geneva, N. Y., has lately increased to such an extent as to necessitate the ordering of another 30 light Brush machine and lamps.

—— The Haverhill Electric Company has been incorporated. Its capital stock is $85,000, and H. A. Pevear, J. N. Smith, C. H. Newhall and W. B. Hosmer are its directors.

—— The city Council of Atlantic City, N. J., last week, after long parleying, have granted a charter to the West Jersey Railroad Company for constructing an electric overhead road along Atlantic avenue.

—— At a meeting of the directors of the Burlington, Vt., Gas Light Co., held last week, it was decided to add an incandescent light plant to their works, and they expect to have it in full operation by January 1.

—— The Tacoma, W. T., Light and Water Company, in order to supply more light, will put in two 50-light dynamos, a large engine and other machinery. J. H. Haughton is secretary and treasurer of the company.

—— The town of Barre, Vt., having contracted with the Standard Light and Power Company, of Montpelier, to furnish 35 electric arc lights, Thomson-Houston system, for the village, work has been begun, and lights will be in operation January 1, 1889.

—— The Brush Electric Company, Cleveland, Ohio, have recently sold to the Brush Electric Lighting Company, Lafayette, Ind., one 300 light incandescent machine and one 45 light arc machine, with dial, etc. This is for increasing the plant at Lafayette, Ind.

—— The Brush Electric Company, of Cleveland, Ohio, have lately received an order for a machine having a capacity of thirty 2,000 candle power lamps, together with a full complement of lamps for same, to be used for central station lighting in Mexico.

—— A syndicate of New Yorkers having obtained valuable concessions from St. Joseph, Mo., are actively at work pushing the work of electric lighting and equipping cars of the street railroads. The syndicate have already let the contracts for the electric cars to the Sprague Motor Company.

On the Absolute Vacuum as a Non-Conductor of Electricity, and the Important Bearing of the Fact Upon Electric Theories.

A PAPER READ BY DR. P. H. VAN DER WEYDE BEFORE THE N. Y. ELECTRICAL SOCIETY.

The historical exhibition which I furnished at the late American Institute Fair, contained several series which, for want of space, could not be separately shown, as would have been desirable if space had permitted. In fact, everything was to a great degree mixed up for the reason referred to.

Among these series, electricity in vacuo formed a prominent and important feature, and because this is a subject so little understood and even misunderstood by the majority of electricians, and is also neglected in the text books, I felt induced to take this for my subject when I was requested to address the society.

I will treat the subject historically, and therefore begin with calling your attention to the experiments of Nollet, recorded in this little book, published in Paris, 1753, and illustrated with carefully engraved figures. His experiments consisted in passing a current of static electricity through glass flasks, from which a large portion of the air had been previously removed by the air pump. He found that the electric current passed as a luminous stream which was very bright when the room was darkened, while luminous pencils were thrown off toward the sides of the flask, if they were touched by the fingers or any other conductor of electricity.

Some 30 years later a variation of this experiment was contrived, consisting of a strong glass tube of about two or three inches diameter, and three or more feet long, provided with brass caps at each end, which could be conveniently attached to the air pump and exhausted. As the exhaustion proceeded, the rarified air in the tube became a conductor of electricity, while this conductivity appeared to improve in proportion as the air was more exhausted. At last a regular stream of electricity was seen to pass through the tube, which stream resembled strikingly the luminous colored streams seen in the aurora borealis, wherefore such a tube was called the "aurora tube," and under that name is found in most philosophical collections.

This apparatus was exhibited at the fair, the exhibit consisting of an old historical air pump, made about 1780, with the aurora tube screwed on the top of it. A few other smaller devices of a similar nature were less conspicuous, and about them I wish only to remark that when using an ordinary air pump, it appeared that the conductivity of the air increased in proportion to the amount of exhaustion; hence the impression became prevalent that if we could only form a perfect vacuum, we would have the best of all conductors, and this idea is, unfortunately, even at the present day, shared by several prominent electricians who have not had the opportunity to keep themselves posted in regard to the discoveries made during the last few years, especially those made by Crookes, Gassiot, Spottiswoode, Gordon and others.

I must not omit to mention that before the latter discoveries, Geissler, in Germany, began to furnish investigators with a great variety of glass tubes of various fanciful shapes, made of different kinds of glass and filled with various gases and vapors, exhausted by the air pump or by being heated, and then sealed up by the blow pipe, while platinum or aluminum wires were inserted at the extreme ends, so as to conduct the electric current through the rarified gases inside. As those tubes exhibited a series of striking and beautiful phenomena, they became very popular, and no physical collection is considered complete without a set of such tubes. They give occasion to exhibit the auroral phenomena, and similar ones of the same character without the trouble of continually working the air pump.

I had two sets of such tubes on exhibition at the fair; one was extra large, the tubes being three and four feet long, and another set of tubes as many inches in length, and which I shall have the pleasure to exhibit to you to-night, being much easier and safer to transport than large tubes.

I will now proceed to make a statement of the facts as they are. They are startling and difficult to explain without the knowledge of the new conceptions of Professor Crookes regarding the nature of matter in the four different conditions, in which it presents itself to us.

The facts referred to are: The atmosphere in its ordinary condition is a very good non-conductor of electricity, provided it is perfectly dry and under a pressure equal to a mercurial barometric column of 760 millimetres or higher.

It is an important consideration, that if the air in which we live were a good conductor of electricity, man could never have become acquainted with electrical phenomena, as then static electricity could never have been collected, studied and experimented with; as this form of electricity was the key to the other different forms, the latter would never have been discovered.

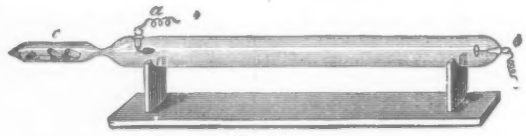


FIG. 1.

When rarified by the air pump to a quarter of the normal pressure, the insulating qualities of air are not so good, and when reduced to a pressure of 10 or 20 millimetres it is a good conductor and exhibits the phenomena referred to before. As this is about the limit attainable by an ordinary air pump, it is very natural that experimenters became possessed of the idea stated above, that the conductivity of the air would keep increasing as the exhaustion proceeded, but after the Sprengel mercurial air pump was invented, by which the air can be exhausted to a thousandth of a millimetre of mercurial pressure (which is about equivalent to one-millionth part of ordinary atmosphere pressure), it was found that the capacity of the air to show the auroral phenomena in the usual way ceased.

The electric current then behaves in a very different manner, as it radiates in straight lines and cannot turn corners, so that when the tubes are bent it gives occasion to very striking and novel phenomena, which were first brought forward by Professor Crookes in the tubes which are known by his name.

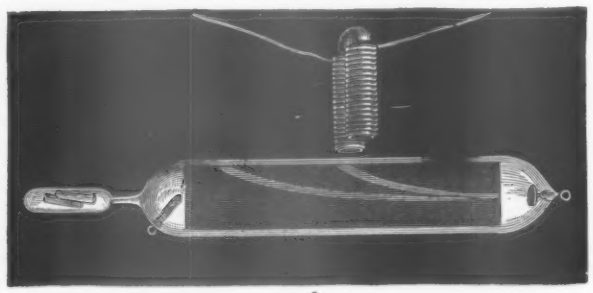


FIG. 2.

The difference between the Geissler tubes and the Crookes tubes is, that in the first the vacuum is very imperfect. In the Crookes tubes it is about a thousand times better, while if we succeed in making the vacuum a million times better, the conductivity of the air ceases absolutely. To accomplish this we must aid the function of the Sprengel air pump by some chemical device which will remove the last remnant of air. It then becomes an absolute non-conductor, which ordinary atmospheric air is not, because it is possible to pass currents of high tension in the form of an electric spark through the densest and dryest air. In the absolute vacuum, however, it is impossible to pass, over the space of a quarter inch, a spark which, when leaping through air, will be six or more inches long.

I exhibit here such a tube in which the two platinum wires are brought together within a distance of scarcely a quarter inch. In this tube a vacuum did exist so perfect that is was impossible to pass a spark through, which through air would leap over a distance of more than six inches. I found that the spark would rather pass over the outside of the tube for that distance than go through the interior. In order to satisfy myself that no trace of electricity passed through the interior space of a quarter inch, I connected one of the platinum wires with a Leyden jar, wound a brass chain half way round the middle part of the tube and connected this brass chain with the ground, in order to prevent any electricity from reaching the Leyden jar through the air along the outside, but I was not able to obtain the least trace of a charge in the Leyden jar. Later I increased the strength of the current more and more, until at last something happened in the tube which destroyed the vacuum; something volatilized, covering the sides of the glass interior with a blackish deposit, which may perhaps be platinum black, a thing which may not be impossible, if we consider that the electric discharge furnishes us the highest temperature which we can possibly produce by any means.

For more than 20 years I have preached this non-conductibility of a perfect vacuum, as it was proved by experiments with the Ruhmkorff coil, by de la Rive and du Moncel. The latter describes the experiments in his book, "Sur l'appareil d'induction de Ruhmkorff," published in Paris about 25 years ago.

It has not a little surprised me that the priority of this discovery is so remote as I found it to be, and that so important a fact as that of the non-conducting power of a perfect vacuum has been overlooked and ignored for nearly a century after it was proved by experiment. I found in the "Philosophical Transactions" for 1785, page 272, vol. 75, the extract of a paper read by Morgan before the Royal Society, and which I published eight years ago in the *Practical American*, which I edited at that time. The paper referred to states that a mercurial gauge 15 inches long, filled with pure mercury which was boiled in the glass until all air was expelled, was coated with tin-foil five inches down from its sealed end, and was inverted into the mercury in a little trough, through a perforation in its brass cap; the air over the mercury in the trough was then exhausted, when the mercury in the gauge fell down more or less in proportion of this exhaustion, but had always a perfect vacuum over it; if, then, the tin-foil coating upper end of the tube was connected with the conductor of an electric machine, not the smallest ray of light nor the slightest charge could be procured in this exhausted gauge; but, if the mercury had been imperfectly boiled, colored luminous phenomena were seen. The same was the case when the sealed end of a perfectly exhausted tube became cracked so that a little air had access; at first the electric charge passed with a yellow or green light; more air made the color a beautiful green, then blue, from blue to indigo; more air still, violet and purple, until the medium became so dense as to no longer conduct electricity. The writer closes with the observation: "I think there can be little doubt, from the above experiments, of the non-conductive power of a perfect vacuum. This seems to prove that there is a limit even in the rarification of air, which sets bounds to its conducting power; or, in other words, that the particles of air may be so far separated from each other as no longer to be able to transmit electricity; that if they are brought to within a certain distance of each other, their conducting power begins, and continually increases, till their approach also arrives at the limit.

Crookes, in order to explain the peculiar behavior of electric discharges through his highly exhausted tubes, teaches the doctrine that our conception of three states of matters, solid, liquid and gaseous, is incomplete; he says that there is a fourth condition, which he calls radiant matter. He teaches as follows:

In solid bodies the atoms are in a state of rest; that is to say, as far as their relative position is concerned, but each atom oscillates to a greater or lesser degree. If the amplitude of the oscillation is small, we call the body cold; if the amplitude of the oscillation is large, we call the body hot; and, in so far, Crookes' theory agrees with what Tyndall has popularized in his well-known work, entitled "Heat as a Mode of Motion."

When the amplitude of the oscillations becomes so great that the atoms turn over and commence to rotate around their centers, the body reaches its melting point and becomes a liquid. Therefore, in liquids the atoms are not rigidly fixed to certain positions, but can freely roll over one another, and this constitutes the difference between solids and liquids.

When the velocity of the rotation becomes greater and greater, we say that the liquid is becoming hotter, and when from some cause or other this motion is still further increased, a new set of phenomena begins. The atoms are projected into space, and in place of rotating they are propelled from the liquid, and also repel one another, and as millions upon millions exist in the small space of a cubic inch, collisions take place by billions, and the body enters in what we call the "gaseous" condition.

In considering the motion of the atoms of gaseous matter, we enter the other extreme of the conception of great and small. It appears that the number of atoms in one cubic inch of the common air we breathe is represented by a series of more than 20 figures, which particles or atoms are in constant continual collision to the number of ten million per second, while the velocity is so great that, if moving in a straight line, they would pass through a space of 11,000 feet in a single second, thus surpassing the velocity of sound 10 times. This is the nature of the third or gaseous condition.

The fourth condition, attained by the Sprengel air pump, is called by Crookes radiant matter. It is reached when the exhaustion proceeds so far that there are so few atoms left as to make the collisions exceptional; then the atoms will move in straight lines, and encountering no mutual hindrance to their motion they will follow the laws of electric repulsion and *radiate* from the point charged with electricity; hence matter in this condition is called "radiant matter."

Now we come to the most interesting feature of our consideration, namely, the chemical device referred to above, and intended to remove this last trace of air; recourse is had to the strong chemical affinity of potash for carbonic acid. The exhausted tube is filled with carbonic acid gas and again exhausted, and this process repeated in order to make sure that no atmospheric air is left, but only very rarified carbonic acid gas. A recess is connected with the tube, undergoing the operation, in which recess is placed a small stick of pure caustic potash. This recess is heated by a spirit lamp, so as to drive out the carbonic acid which the potash may contain and then the vacuum is again made. The last remnant of carbonic acid which the air pump cannot remove is then absorbed by the potash, when this is allowed to cool down. In this way the absolute vacuum is produced, through which no electric current can be made to pass.*

The bearing of this fact is of the utmost importance in regard to our conception of the nature of electricity. It is generally admitted that the theory of the existence of a caloric fluid is erroneous, and that heat is merely a peculiar mode of motion, as referred to above, and this view is adopted, notwithstanding there is no experiment known serving to demonstrate that heat cannot be transmitted through a space absolutely devoid of all matter. Heat and light will both pass through a vacuum perfect enough to obstruct absolutely the passage of electricity. If there were such a thing as an electric fluid, it surely would pass through any empty space, and we are therefore driven to the conclusion that the presence of matter is as absolute a condition for the transmission of electricity as the presence of air is an absolute condition for the transmission of sound; and there is as little necessity to accept the hypothesis of the existence of an electric fluid as there is for the hypothesis of a sonorous or caloric fluid.

On a future occasion I hope to have the satisfaction to show you that all the peculiarities presented in both cases may be satisfactorily accounted for by the lately discovered facts to which I have called your attention to-night.

*Of the accompanying two cuts, Fig. 1 represents an arrangement similar to the tube exhibited at the lecture, while Fig. 2 shows that as direction of the magnetic needle may be deviated by a wire conducting an electric current, *vice versa*, the direction of a flow of an electric current in a partial vacuum will be affected by magnetic influence, as shown by the results of charging and discharging the electric magnet seen suspended over the tube.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING DECEMBER 11, 1888.

394,153 Lamp hanger; Daniel Chisholm, Utica, N. Y.
394,161 Electric dispatch tube; William Dulles, Jr., New York, N. Y.
394,164 Electric contact maker; James S. Farmer, Salford, County of Lancaster, England.
394,172 Signaling dynamo electric machine; Elisha Gray, Highland Park, assignor to the Western Electric Company, Chicago, Ill.
394,173 Ringing-off device for telephones; Amenzo Griffith, Springfield, and Henry A. Burbank, Westfield, Mass.
394,180 Cut-out for electric lamps; Charles Heisler, St. Louis, Mo.
394,192 Electrical fuse; James Macbeth, Brooklyn, N. Y.
394,195 Bridge for cutting in new loops in telephone systems; George S. Maxwell, Louisville, Ky.
394,203 Electro-magnetic air compressing rock drill; Richard G. G. Moldenke, New York, N. Y.
394,207 Electric underground conduit; David O. Paige, Detroit, Mich.
394,220 Electric valve operating device; Frank M. Sparrow, Mattapoisett, Mass.
394,230 Telephone central station apparatus; Theodore N. Vail, Boston, Mass., and John A. Seely, New York, N. Y.
394,302 Printing telegraph; George V. Sheffield, Schenectady, N. Y., assignor to himself and Lewis Sickler, same place.
394,307 Thermo-electric valve controller; Frank M. Sparrow, Mattapoisett, Mass.
394,332 Electro-mechanical movement; Bassett Cadwallder, Chicago, Ill., assignor to the Inter-Ocean Electric Company, same place.
394,380 Wire holder for insulators; Edwin L. Lloyd, Philadelphia, Pa.
394,413 Thermotic circuit closer; William H. Soley, Philadelphia, Pa., assignor of two-thirds to Frank Soley and James Wolstencroft, both of same place.
394,417 Safety device for electric motors; Charles J. Van Depoele, Chicago, Ill.
394,471 Secondary battery; Louis Duncan, Baltimore, Md.
394,472 394,473 Method of making secondary battery plates; Louis Duncan, Baltimore, Md.
394,474 Secondary battery; Louis Duncan, Baltimore, Md.
394,485 Electro-magnetic switch; William W. Griscom, Haverford College, Pa.
394,491 Electric alarm and water guage; John H. Johns, National Military Home, Kansas.
394,525 Safety device and signal for electric motors or generators; Charles J. Van Depoele, Chicago, Ill.
394,541 Electric distribution by secondary batteries; Zach Latshaw, McKeesport, Pa.

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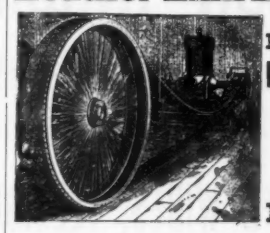
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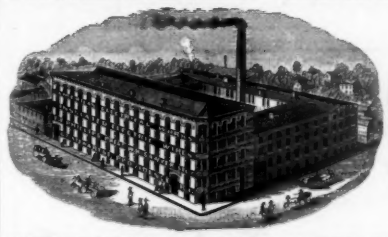
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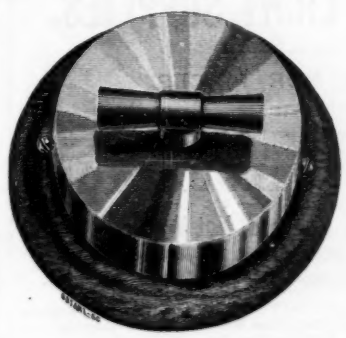
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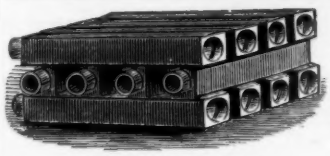
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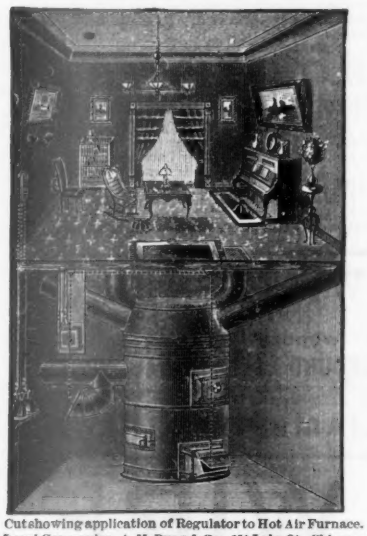

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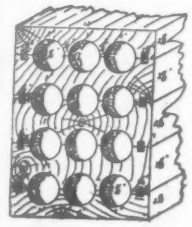

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